US Army Corps
of Engineers
Southwestern Division
Tulsa District

PINE BLUFF ARSENAL

Site 24
Thermite Disposal
Area

Site Closure Plan

XREF SAVOL-1

AUGUST 1985

PINE BLUFF ARSENAL
SITE 24
THERMITE DISPOSAL AREA

SITE CLOSURE PLAN

DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
TULSA, OKLAHOMA

PINE BLUFF ARSENAL
SITE 24
THERMITE DISPOSAL AREA

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SYNOPSIS

Site 24, Thermite Disposal Area at Pine Bluff Arnsenal, Arkansas, will be closed in FY 86 Military Construction, Army (MCA) project in accordance with all applicable State and Federal regulations. The general investigative procedures followed at Site 24 were to establish the extent and nature of contamination of waste materials both on the surface and in the underlying soils. This included investigations sufficient in scope to determine the vertical and horizontal limits of contamination and to determine which contaminants would classify as hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). The contamination at this site is heavy metals from the past use of Site 24 as a dump for thermite residue from the Quality Assurance Drop Tower (Site 26) and for bomb wash from the BZ Pond (Site 27). The heavy metals are contained not only in the bomb wash and thermite residue fill but have migrated into the underlying soil. Based on a statistical analysis of the lead EP toxicity test results, the entire volume of contaminated fill and soil classifies as hazardous waste. The perched groundwater system at the site is contaminated, but the deeper, permanent water table is not contaminated.

Additional investigations were made to determine the most cost effective means of closure that would satisfy the requirements for final disposal of waste material at the site. The subsurface investigations indicate that the site is underlain by a bed of clay-shale varying from 1-5 feet in thickness which is not thick enough to utilize as a lower impermeable barrier in an in-situ encapsulation scheme The clay-shale layer is underlain by a silty and clayey sand

The proposed on-site closure plan would not significantly disturb the contaminated materials, consequently these hazardous wastes would not be generated as RCRA wastes and RCRA disposal regulations would not be applicable. This plan would isolate the contaminated material at the site by constructing facilities to prevent percolation of surface and groundwater through the contaminated material and control groundwater levels down to an elevation below the contaminated material. Construction would include perimeter slurry walls, a french drain system to lower the perched groundwater table, removal of the perched water within the closure cell, drainage ditches and containment dikes to control runon/runoff and a synthetic liner cover system to eliminate rainwater infiltration from above the cell Approximately 44,000 cubic yards of contaminated hazardous waste material would be closed in-place at a cost of $2,258,000. The proposed closure plan will result in a savings of $4,547,000 as compared with the estimated cost for off-site disposal and is considered to be the most economical and environmentally acceptable alternative, based on the data presented in the following narrative.

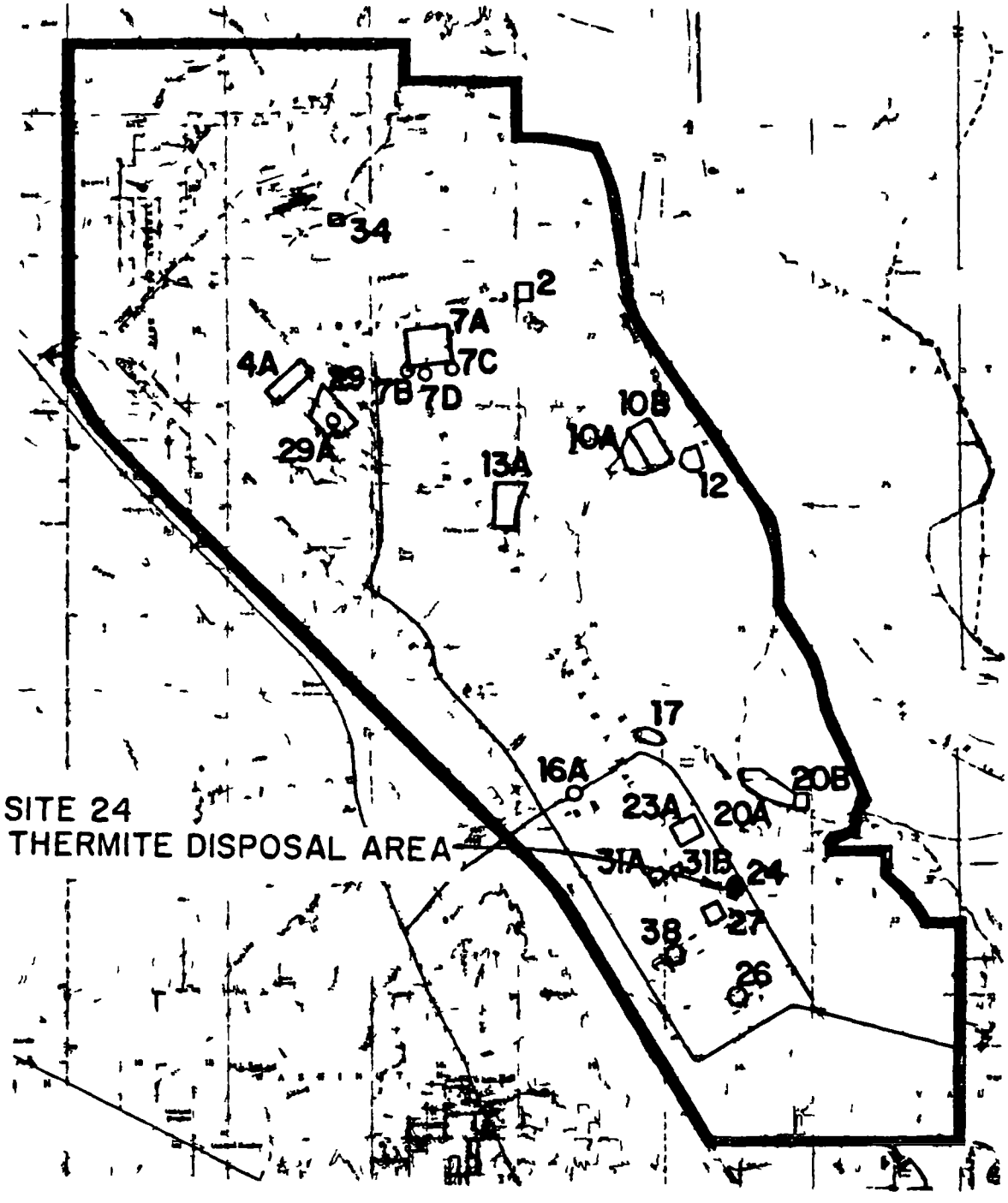
I - GENERAL

1-01. Purpose. This report presents the closure plan for contaminated waste materials located at Site 24, the Thermite Disposal Area at Pine Bluff Arsenal, Arkansas. This site is an inactive site and will be permanently closed in accordance with applicable State and Federal regulations. Closure of this site is required to eliminate an historical open dump and prevent contamination of the waters of the State of Arkansas. Discussions between Arkansas Department of Pollution Control and Ecology (ADPC&E), Tulsa District, Corps of Engineers (TDCE), and Pine Bluff Arsenal (PBA) personnel determined that remedial actions must be conducted at this site in response to an administrative consent order issued to PBA by the ADPC&E. It was jointly decided to use a negotiation process between the parties similar to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Criteria for hazardous waste set forth in the Resource Conservation and Recovery Act (RCRA) were used to classify materials and manage wastes which will become subject to RCRA during the remedial action process. Cleanup limits for RCRA-listed metal contaminants were dictated by ADPC&E and related to both total ion and EP toxicity testing (see table 3-1).

1-02. Report Format. A site description is presented in Section II. The geotechnical and contaminant investigations which form the basis for the proposed closure plan for this site is presented in Section IV. The indicated closure plan is considered to be the most technically feasible, cost effective, and environmentally acceptable alternative based on the results of geotechnical and contaminant investigations alternative design studies and existing site conditions. An alternative closure plan studied and comparative cost estimates are presented in Sections V and VI, respectively.

II - SITE DESCRIPTION

2-01. Site Description. Site 24, the Thermite Disposal Area, is a 4-acre barren site covered with thermite and bomb wash residue about 3 feet in thickness. It is located on Stokes Road in the Production Area as shown on figure 2-1. Thermite residue from the Quality Assurance Drop Tower (Site 26) was disposed of at the site in the 1940's and early 1950's, and bomb wash from the BZ pond (Site 27) was dumped at the site from 1959 to 1961. Bomb wash is starter mix (a material containing red lead) which was washed out of thermite and other rounds at the bomb wash facility in building 32-570. No dumping has occurred at Site 24 since 1961. Approximately 288 yards of surface fill was removed in February 1984 as part of an Emergency Service Contract. About 44,000 cubic yards of bomb wash, thermite residue, and contaminated soil remain at the site. Contaminated material from the site has washed into a stream which flows along the southeastern boundary of the site. The stream is considered to be a part of the site from the point at which material from the site first enters the stream to the point at which the stream goes under Stokes Road. Photographs of the site are shown in Appendix I.



PINE BLUFF ARSENAL

CLOSURE SITES

FIGURE 2 - 1

III - GEOTECHNICAL CONTAMINANT INVESTIGATIONS

3-01. Introduction. The purpose of the exploration program was to (1) define subsurface conditions and (2) define the type, severity, and lateral and vertical extent of contamination.

3-02. Field Investigatons.

a. Preliminary. Eighty-one shallow borings, about 10 feet deep, were drilled in 1973-1975 for the Contaminated Area Survey Project. These samples were tested for heavy metals but were not classified or described. In 1981, one upgradient and three downgradient groundwater monitoring wells were installed. Drill cuttings from these holes were logged in the field. Monitory well locations are shown on drawing 1.

b. Auger Sampling. Forty-nine auger holes 5 to 40 feet deep and two denison holes were drilled during the spring and summer of 1984 as shown on drawing 1. Hole 27-22, southwest of the site as shown on figure 3-1, was drilled to provide background chemical information for the soil at Pine Bluff Arsenal. Soil from the auger holes was described in the field and classified in the laboratory. Each run was limited to 3 feet. To prevent mixing of materials or sampling material that had pulled off from the wall of the hole, only the interior portion of each sample was used. Material was taken from the entire 3-foot sample, sealed in glass jars, and shipped to the Corps of Engineers Southwestern Division (SWD) Laboratory in Dallas. Groundwater was sampled in selected holes and analyzed for heavy metals. If the hole penetrated a clay layer, it was backfilled with grout.

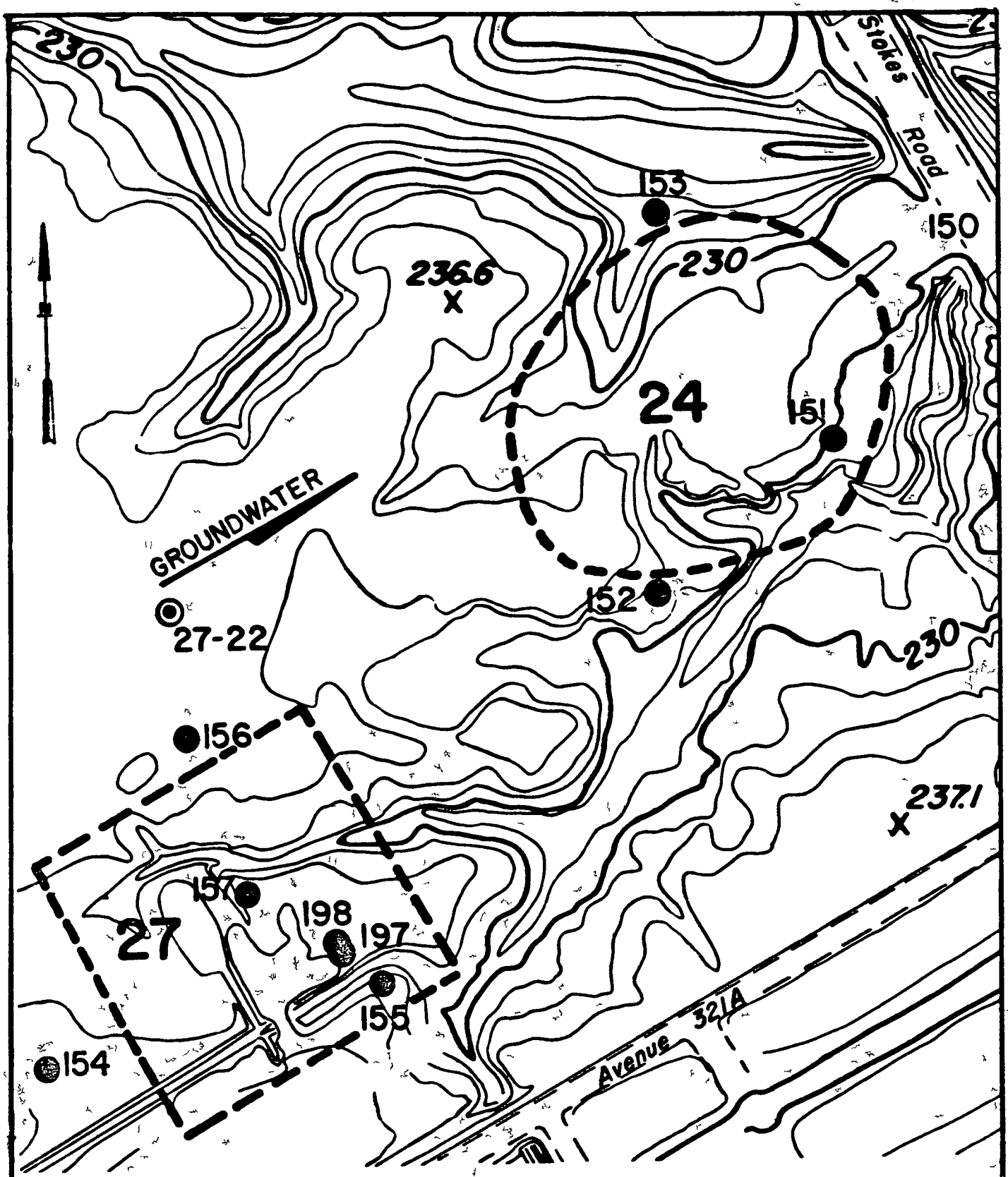
c. Peizometer Installations. In order to better determine the quality and elevation of the ground water at Site 24, 6 piezometers were installed in the perched water table and 4 were installed in the permanent water table.

3-03. Laboratory Testing. All chemicals and physical testing of soil and water samples was performed by the SWD Laboratory in Dallas, Texas, or laboratories contracted by them. Laboratory results are contained in Appendix II.

a. Chemical Testing Procedures.

(1) Metals.

(i) Total ion Testing. Soil samples were digested in strong acid and the resulting extracts were tested by atomic absorption spectroscopy techniques. The acid treatment resulted in total ion extraction, freeing the metals from the soil and pore water. A representative portion of the sample was oven dried and the values reported in milligrams/kilogram (mg/kg) dry weight. Tests were conducted for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver concentrations (the eight RCRA listed toxic heavy metals contaminants). In addition, zinc concentrations were determined because of its suspected presence at the site even though it is not a RCRA listed contaminant. Groundwater samples were filtered in the lab and given a similar acid treatment. The water sample results are reported in milligrams/liter (mg/l).



SITES 24 & 27
BACKGROUND HOLE LOCATION

LEGEND

● Groundwater monitoring well

◉ Background hole

SCALE 1" = 200'

FIGURE 3-1

(ii) EP Toxicity Testing. Extraction Procedure methodology, commonly referred to as EP toxicity testing, is much less rigorous extraction of metals, designed to simulate typical leaching conditions in a landfill. Results are reported in mg/l (as a concetration in an extract obtained in a specified manner).

(2) Organics. Two soil samples were tested by gas chromatograph mass spectroscopy (GS/MS) techniques. The samples were analyzed for purgeable organics, base/neutral extractable organic compounds, acid extractable organic compounds, and pesticides listed in the August 1980 EPA list of priority pollutants.

b. Laboratory Soil Classification. Atterberg limits, sieve analysis, and natural water content tests were performed on selected soil samples. The resulting classifications, based on the Unified Soil Classification System, are used to identify material types shown in the geologic sections presented on drawings 3 and 4. Laboratory visual classifications were used to verify filed classifications.

c. Laboratory Permeability Test. Falling head permeability tests were performed on undisturbed (dension) samples of the Jackson clay-shale.

3-04. Analysis.

a. Contamination Background Levels and Cleanup Limits. An administrative consent agreement between the ADPCE and PBA is the basis for this remedial action. This agreement is predicated on Arkansas law which prohibits pollution of Arkansas waters but does not identify contaminants or allowable limits. Through discussions and letters, the ADPCE identified parameters and concentrations of concern as follows:

(1) Heavy Metals.

(i) Total ion Testing. The maximum contaminant level (MCL) for the 8 heavy metals listed in RCRA (40 CFR 261.24) were set at 10 times the background levels. "Arenal-wide" background levels were calculated as the mean of 102 samples collected at uncontaminated areas near 17 of the sites.

(ii) EP Toxicity Testing. In addition to meeting the MCL for the total ion method, the ADPCE also required that the samples not exceed one-tenth the regulatory values shown in RCRA (40 CFR 261.24) when analyzed using EP methodology. Table 3-1 lists background levels and MCL's (cleanup limits) for these heavy metals.

TABLE 3-1
HEAVY METAL BACKGROUND LEVELS AND CLEANUP LIMITS

Contaminant	Background Mean (mg/Kg)	SITE CLEANUP LIMITS Total Ion MCL (mg/kg)	SITE CLEANUP LIMITS EP Toxicity MCL (mg/l)
Arsenic (As)	1.3	13.0	0.5
Barium (Ba)	28.7	290.0	10.0
Cadmium (Cd)	< 0.5	5.0	0.1
Chromium (Cr)	< 5.0	50.0	0.5
Lead (Pb)	7.55	75.5	0.5
Mercury (Hg)	< 0.1	1.0	0.02
Selenium (Se)	0.18	1.8	0.1
Silver (Ag)	< 0.5	5.0	0.5
Zinc (Zn)	8.5	1/	1/

1/ Background level for zinc was determined since it is a common constituent of demilitarized ordnance wastes. Zinc is not a RCRA listed contaminant; therefore, cleanup limits were not required by ADPCE.

(2) Organics. A GC-mass-spectrometer scan was conducted on samples from those sites where there is evidence of disposal of organic compounds. At those sites where the tests revealed the presence of compounds listed in RCRA (40 CFR 261.33), an individual determination of the substance hazard was made. This was dependent on the compounds and the amount present in the sample. This determination was used to develop the recommended closure plan and is subject to approval of the ADPCE. The organic compounds of primary concern are not naturally occurring, therefore, no organic testing was conducted on background samples collected in uncontaminated areas.

b. Determining Extent of Metal Contamination. Samples from hole 24-1, in the middle of the waste, were tested for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and zinc. Four RCRA-listed metals (barium, cadmium, chromium, and lead) were found to be present in high concentrations and were selected for further testing. EP toxicity tests were also performed at the site boundaries to insure that MCL's were met for both total ion and EP toxicity criteria. The depth to which soil would be contained or removed in the cleanup of Site 24 was determined by comparing the measured values of each contaminant with the cleanup values presented in Table 3-1. This data is presented graphically for each boring in Appendix III. With the results plotted in this manner, the depth of contamination and the depth of soil to be contained or removed is easily determined. The plots also show contamination in the fill material whether or not samples of the material were tested.

c. Contamination Results.

(1) Fill and Underlying Soil, Total Ion Testing. Approximately 3 acres of Site 24 are covered with fill. An isopach of contaminated materials (fill and soil) is presented on drawing 2. The primary contaminants are barium, cadmium, chromium, and lead. Barium concentrations are as high as 1900 mg/kg in the fill and 7200 mg/kg in the soil. Cadmium concentrations range from 300 mg/kg in the fill to 1200 mg/kg in the soil. Chromium concentrations are as high as 3300 mg/kg in the fill and 880 mg/kg in the soil. Lead concentrations range from 18,000 mg/kg in the fill to 300 mg/kg in the soil. The lead contamination is confined to the fill and the first two or three feet of soil directly beneath it. However, barium, cadmium, and chromium have migrated deeper, with concentrations of cadmium and barium in the soil exceeding the concentrations in the overlying fill. One area of the site was apparently a disposal trench for waste. Hole 24-3 encountered fill from 0 to 14.5 feet. The soil was highly contaminated with lead, barium, cadmium and chromium to a total depth of 17.0 feet. The terrace clays have stopped vertical migration of the metal contaminants over a portion of the site. However, in the streams and in the western portion of the site, the clays are not an effective lower boundary. The total quantity of contaminated material at site 24 is estimated to be 44,000 cubic yards. Limits of contamination are shown in plan on drawing 2 and in section on drawings 3 and 4.

(2) Fill and Underlying Soil. EP Toxicity Testing.

(i) Contaminated Volume Sampling. It is necessary to classify the contaminated material as hazardous (as defined by RCRA) or non hazardous. Because of the large volume of material involved, samples of the waste were taken and analyzed statistically. The samples must be taken randomly by both area and depth within the boundaries of the affected waste area (as defined by maximum contaminant levels presented in Table 3-1). Twenty-six points within the waste were sampled and metal contents determined using EP methodology with the results shown in Table 3-2. Lead and cadmium were present in the highest concentrations and lead was selected for analysis. Two methods of statistical analyses were used to determine the probable lead content of the waste. The first of these, based on a simple random sample is taught in the EPA course, "Sampling for Hazardous Materials." It yields an upper 95% confidence interval of 32.05 mg/l which is greater than the RCRA EP Toxicity Limit of 5 mg/l. The second, based on stratified random sampling, yield an upper 95% confidence interval of 21.81 mg/l, which is also greater than the regulatory threshhold of 5.0 mg/l. Both methods indicate that the material at Site 24 has hazardous waste characteristics in terms of EP toxicity.

TABLE 3-2
RESULTS OF EP TOXICITY ANALYSIS - RANDOM MATERIAL SAMPLES
(mg/l)

Hole 1/	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se
1	1.0-2.0	<.01	.10	1.33	.01	.01	<.0001	.04	<.0004
1	3.0-6.0	<.01	.09	.50	.01	<.01	.0001	.04	<.0004
2	1.0-2.0	.06	.001	42.0	.043	.57	.0003	3.1	<.0004
2	3.0-6.0	<.01	<.001	4.0	.013	.33	.0001	.10	<.0004
3	0.0-1.0	<.01	.08	<.50	.05	<.01	<.0001	7.74	<.0004
3	1.0-2.0	<.01	<.001	<.50	.293	.13	.0001	69.0	<.0004
3	12.0-14.0	<.01	.001	8.7	17.0	1.2	.0001	33.0	<.0004
4	1.0-2.0	<.01	<.001	12.0	.355	.30	.0002	260.0	<.0004
4	3.5-5.5	<.01	<.001	3.6	.763	.54	.0003	.27	<.0004
5	0.5-1.0	<.01	<.001	<.50	.120	<.01	<.0001	<.01	<.0004
5	6.0-6.5	<.01	<.001	<.50	.825	.23	<.0001	<.01	<.0004
6	0.0-1.0	<.01	<.001	2.9	.200	.27	<.0001	.02	<.0004
7	0.0-1.0	<.01	<.001	5.9	4.1	.12	<.0001	.07	<.0004
7	2.0-3.0	<.01	<.001	1.5	.30	<.01	<.0001	.06	<.0004
8	1.0-2.2	<.01	.004	<.5	.078	.01	<.0001	.15	<.0004
11	1.0-2.0	<.01	<.001	17.0	12.0	.21	<.0001	.05	<.0004
11	2.0-3.0	<.01	.002	1.3	.205	.24	<.0001	.08	<.0004
14	0.0-1.2	<.01	<.001	<.50	<.002	<.01	.0002	.08	<.0004
14	1.2-2.2	<.01	<.001	<.50	.005	<.01	<.0001	.09	<.0004
14	2.2-3.2	<.01	<.001	<.50	.003	<.01	.0002	.09	<.0004
18	0.0-1.0	<.01	<.001	41.0	.908	.19	<.0001	.10	<.0004
18	3.0-6.5	<.01	<.001	9.5	.060	.14	<.0001	.04	<.0004
27	1.0-2.0	<.01	<.001	3.9	.248	.91	<.0001	4.97	<.0004
27	4.5-7.5	<.01	<.001	11.0	29.0	<.01	<.0001	.07	<.0004
31	2.0-4.0	<.01	<.001	3.0	.31	.04	<.0001	.08	<.0004
31	5.0-9.0	<.01	<.001	<.50	.758	<.01	<.0001	0.4	<.0004
RCRA Limit		5.0	5.0	100.	1.0	5.0	0.2	5.0	1.0

1/ For location of sample tested for EP toxicity see the boring column in the Boring-Contaminant Plots (Appendix III).

ii. Boundary Testing. The limits of soil or waste volume contamination were initially determined by finding the point at which total on concentrations in the waste area were below the maximum contaminant levels presented in Table 3-1. EP toxicity tests were performed just inside this boundary to insure that maximum contaminant levels for EP toxicity were met as well. Results of this testing are presented in Table 3-3. The original boundary definition is confirmed since all the tests except two are below 10% of the limit for EP toxicity. Additional samples were tested just below the samples that failed, and met the criteria.

TABLE 3-3
RESULTS OF EP TOXICITY ANALYSIS - BOUNDARY TESTING
(mg/l)

Hole 1/	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se
3	14.5-17.0	<.01	.001	1.33	.273	2/<.01	.0001	.04	<.0004
3	17.0-20.0	--	--	<.50	.005	<.01	--	0.7	--
15	4.8-7.5	<.01	.001	<.50	.005	<.01	<.0001	.15	<.0004
17	0.0-1.0	<.01	.002	.76	.005	.39	<.0001	.04	<.0004
21	2.0-1.0	<.01	<.001	<.50	<.002	<.01	<.0001	.01	<.0004
26	2.0-3.5	<.01	<.001	.67	.095	.77 2/	<.0001	.02	<.0004
26	3.5-4.5	--	--	<.50	.015	<.01	--	.02	--
30	4.0-7.0	<.01	<.001	<.50	.015	.17	<.0001	.02	<.0004
34	3.0-4.5	<.01	<.001	.62	.013	.04	<.0001	.04	<.0004
36	6.0-9.0	<.01	<.001	2.19	.005	<.01	.0001	.03	<.0004
RCRA Limit		5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0

1/ For sample location, see the boring log in Appendix III - Boring Contaminant Plots.

2/ Exceeds the ADPCE Cleanup Limit for EP Toxicity (10% of RCRA limit).

(3) Extent of Organic Contamination. One hole in Site 24 was sampled and analyzed for selected organic contaminants at two depths: (1) at the top of the contaminated soil (approximately 3 to 5 feet in depth) and (2) at the top of the perched water table (11.0 to 12.0 feet in depth). Both locations were found to be highly contaminated with barium, lead, and chromium. Only two organic compounds were detected above the minimum detectable level, di-n-butyl phthalate and chlorobenzene. The concentrations of these compounds are presented in Table 3-4. Concentrations are low and within a factor of 10 times the minimum detectable level.

TABLE 3-4
EPA PRIORITY POLLUTANT ANALYSIS
(mg/kg)

Compound	Boring	Depth	Minimum Detectable Level	Sample Concentration in sample (ppb)
Di-n-butyl phthalate	33	3.0-5.0	0.437	0.514
Di-n-butyl phthalate	33	11.0-12.0	0.514	1.522
Chlorobenzene	33	3.0-5.0	0.010	N/A
Chlorobenzene	33	11.0-12.0	0.010	0.055

N/A = Below minimum detectable level.

(4) Ground Water Contamination. Groundwater encountered at Site 24 belongs to the Jackson/Quarternary aquifer. This aquifer generally yields small amounts of low quality water and is not used for any supply purpose in the vicinity of the arsenal. Drinking water in the area is supplied from the Sparta Sand which is about 600 feet below the site and is separated from it by low permeability Jackson and upper Claiborne groups. Test have been performed on groundwater samples from the 4 monitoring wells over a period of two years (6 rounds of samples). All monitoring wells are set in the permanent water table. Barium and chromium at or just above the detectable limits of .1 mg/l and .01 mg/l (respectively) were found in all wells. Lead was detected in one of the six sampling rounds in all wells in concentrations ranging from .14 to .18 mg/l which are above the drinking water (NIPDWR) standard of .05 mg/l. This one-time high concentration is believed to be due to an error in the analysis of those samples. Perched water table water samples were obtained from holes 24-1 and 24-2. Analyses of those samples revealed elevated concentrations of barium, cadmium and lead, which are present in the fill through which the perched water flows. Barium concentrations were as high as 21 mg/l, cadmium 0.9 mg/l and lead 0.4 mg/l. All chemical analyses of water samples from the Corps of Engineers auger holes are in Appendix II. Based on these results and those of the groundwater monitoring wells, it is concluded that Site 24 is not contributing contamination to the permanent water table; however, the perched water is contaminnated by association with fill debris.

(5) Stream South and East of the Disposal Area. The stream south and east of the disposal area (Site 24) and northeast of the BZ pond (Site 27) is also contaminated. Fill from Site 24 is washing into the stream and contributing to the contamination. Barium and lead are present in concentrations up to 400 mg/kg and 340 mg/kg respectively throughout some of the 5 foot test holes. Chromium was also found to be present in the stream area with concentrations as high as 800 mg/kg at the surface and 1400 mg/kg at a depth of 6 to 7 feet. Since the goal of this closure plan is to remove

or isolate sources of contamination at each dump site, the stream is considered to be a part of Site 24 from the point at which the stream goes under Stokes road. Water in the stream was sampled and had a concentration of .11 mg/1 lead, which exceeds the drinking water quality standard of 0.05 mg/1.

3-05. Stratigraphic Results.

a. General. Site 24 is located on terrace deposits approximately 15 feet thick. These deposits are unconsolidated sand, silts, and clays resting on the Jackson group. The Jackson consists of a thin bed of clay-shale underlain by a silty and clayey sand. The location of this site is shown in figure 3-2 on a map of geologic environments at PBA.

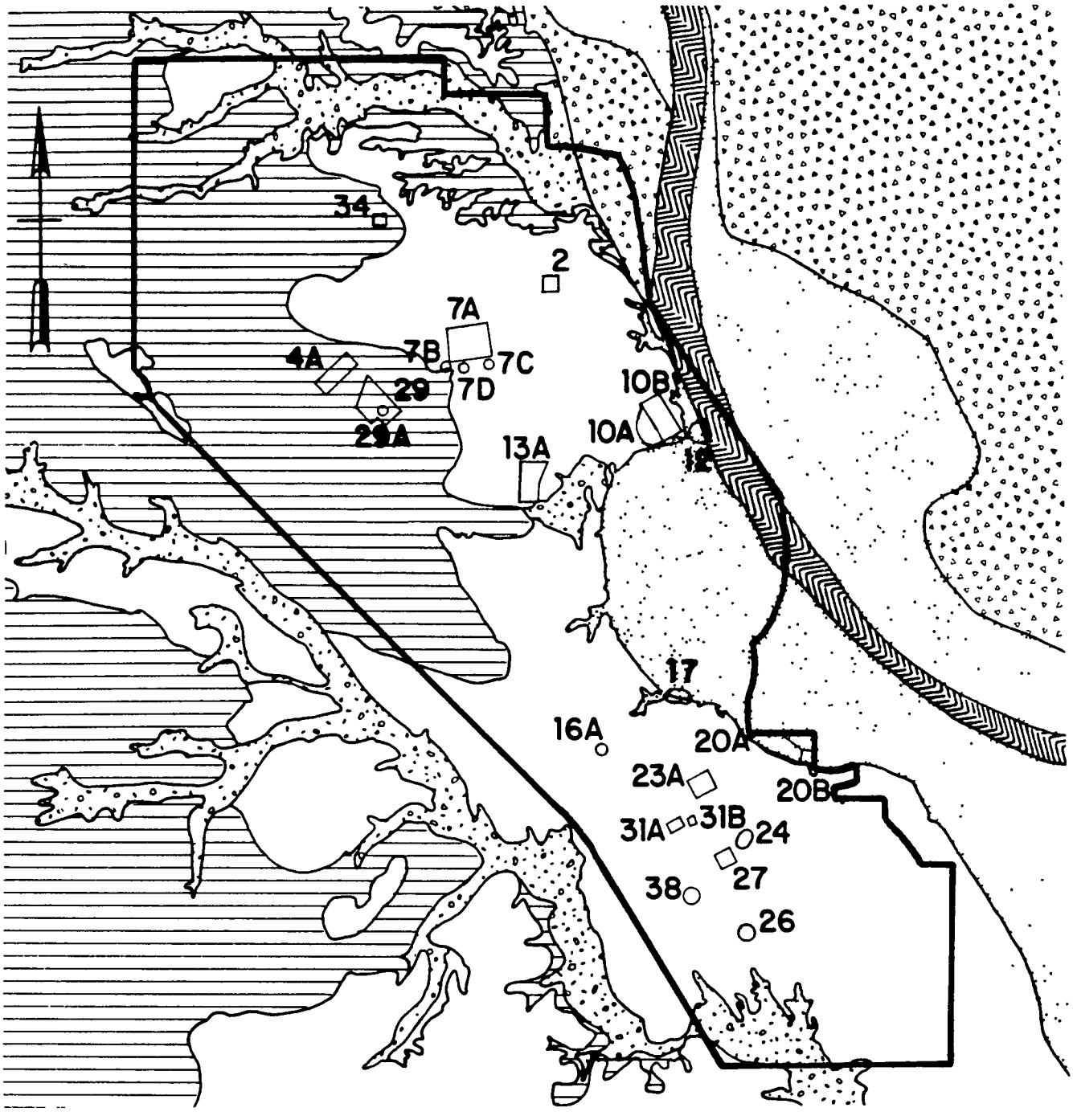
b. Fill. Fill material about 3 feet thick covers approximately 3 acres of Site 24. The fill is gray to red and is similar to sand or silt in texture.

c. Terrace Deposits. Clay is present in excess of 5 feet over the eastern portion of the site but is very sandy and has a liquid limit of about 30. Contamination extends approximately halfway through this clay and it appears that the clay is not an effective barrier to prevent vertical migration of contaminants. Most of the terrace materials consist of silt and sandy silt.

d. Jackson Group. The uppermost bed of the Jackson at the site is a clay-shale varying in thickness from about 5 feet in the monitoring wells (9 feet in well 152) to less than 1 foot in hole 24-1, drilled in the center of the site. It averages 3.4 feet in thickness. The clay-shale has been at least partially penetrated along the existing sanitary sewer alignment. The clay-shale is underlain by sand which is greater than 30 feet thick. A contour map of the top of the Jackson clay-shale is presented in drawing 5.

e. Summary of Clay Deposits. The terrace clay is of questionable quality for use as a barrier to prevent vertical migration of contaminants, and is present continuously over only the eastern portion of the site. The clay-shale is not thick enough to be used for a positive cutoff in an encapsulation scheme. There are no clay strata beneath the site that would be acceptable for use as a lower impermeable boundary in an in-situ encapsulation scheme.

f. Water Table. The permanent water table at Site 24 is about elevation 202, 30 to 35 feet below the ground surface. This water table slopes very gently to the southeast with a gradient of less than 1 feet per mile. The clay-shale supports perched water, which is about 12 to 15 feet below the groud surface. Additionally, terrace deposits clays, where present, support perched water during rainy periods. Several of the borings in the fill had water less than 0.5 feet deep.



ARKANSAS RIVER

ARKANSAS RIVER DEPOSITS

TERRACE

BACKSWAMP

ALLUVIUM

RECENT ALLUVIUM

JACKSON GROUP

GEOLOGIC ENVIRONMENTS

SCALE IN FEET

2000 0 2000 4000

FIGURE 3-2

IV - CLOSURE PLAN

4-01. General. It has been estimated that approximately 44,000 cubic yards of contaminated material is present at this site. Futhermore, this material exhibits hazardous waste characteristics and would, therefore, be regulated by RCRA disposal requirements if the material is significantly disturbed during completion of the closure plan. Consequently, disposal at the hazardous waste landfill is the only environmentally acceptable alternative to the proposed on-site closure plan. Off-site disposal, discussed in Section V, is not economically feasible as illustrated by the cost estimate given in Section VI. The proposed on-site closure plan would not significantly disturb the contaminated materials, consequently, the proposed remedial action would not be governed by RCRA regulations.

4-02. Summary Description. The proposed closure plan would isolate the contaminated material at the site by constructing facilities to prevent percolation of surface and groundwater through the contaminated material and control groundwater levels at an elevation below the contaminated material. The plan features construction of: (1) containment dikes and drainage ditches around the site and a synthetic liner cover system over the site to provide runon control and eliminate vertical infiltration of surface waters, (2) slurry walls around the site extending from the containment dike crest vertically downward to an elevation which would intercept the top of any clay-shale layer supporting perched water and (3) french drains around the site to lower the perched groundwater table outside the contaminated material by eliminating the hydraulic head which would be imposed on the slurry walls under normal perched groundwater head conditions. This construction would also remove the perched water from the contaminated material within the site, eliminating the driving head for vertical migration of contaminants and preventing any other surface or groundwater from entering the site. The proposed closure plan is shown in sectional views on drawing 7 and in plan view on drawing 6. Construction of this closure cell would be accomplished as described hereafter.

4-03. Relocation of Sanitary Sewer. An 18-inch vitrified clay sanitary sewer line runs through Site 24 at a depth ranging from 7 to 10 feet. A new sanitary sewer would be constructed to reroute the alignment around the proposed on-site closure cell. The existing sewer would be removed within the construction limits of the proposed perimeter run-on control channels, french drains, containment levees and slurry wall alignments. It would be plugged and left undisturbed at locations inside the closure cell and at the ends of other abandoned sections between the upstream and downstream tie-in man holes. The proposed relocation of this sewer is shown on drawing 6.

4-04. Run-on Control Facilities and Site Preparation. Diversion channels would be constructed outside the perimeter of the french drain and slurry wall alignments to direct surface drainage around the closure site. Erosion control fabric would be provided on all ditches constructed adjacent to the

closure cell. Clearing and grubbing along the limits of the containment levees, french drains and slurry walls would then be completed. Containment levee construction along part of the slurry wall alignment would follow to assist in preventing run-on of surface water.

4-05. Groundwater Control Facilities. A french drain system would be constructed around the perimeter of the proposed slurry wall alignment to lower the level of the perched groundwater table outside the closure cell. This system would encircle the site, with the drain pipes leading to a collection manhole. Accummulated groundwater would be automatically pumped to a nearby natural drainage ditch by means of a float-controlled duplex pump station, utilizing the collection manhole as its wet well. A level alarm would be provided in the collection manhole to signal operating personnel that the level has reached a higher elevation indicative of either a power outage or malfunction of the duplex pump station. The maximum groundwater flow anticipated in the french drain system would be 2 gallons per minute based on a permeability of 10^{-4} cm/sec, a gradient of 0.025 and a cross sectional area of 16,000 square feet. The pumps would each be capable of delivering at least 20 gallons per minute of flow on an intermittent basis.

4-06. Slurry Walls. The slurry wall alignment would be graded for subsequent construction where containment levees are not required. Contaminated material along the wall alignment would be stripped out and placed inside the closure cell. The slurry trench would then be excavated and backfilled with the bottom of the wall extending to an elevation below the lower limit of contaminated material, resulting in an average wall depth of 14 feet. A soil bentenite backfill would be designed to achieve a permeability of 10^{-7} cm/sec. A wall thickness of 30 inches would be used. It is not anticipated that a hydraulic head would ever be imposed either side of the slurry wall. Run-on control channels constructed outside the wall would be maintained to prevent surface water from overtopping the wall into the cell area.

4-07. Contaminated Material Relocation. Approximately 1400 cubic yards of contaminated material would be moved into the closure cell to allow proper construction of the slurry wall adjacent to Stokes Road. This contaminated material would be spread over the surface inside the cell and compacted in place. When an allowance for overexcavation (15 percent) and bulking during recompaction (20 percent) is made, the material to be moved would increase in volume to 1900 cubic yards. The excavated areas outside the wall would be backfilled with random fill material and topsoil.

4-08. Closure Cell Dewatering. The perched water within the closure cell would be removed by means of a well point dewatering system. If found to be contaminated, the groundwater removed would be transported to the industrial waste treatment plant for disposal. If testing proves this water to be uncontaminated, it would be discharged directly to the drainage ditch located north of the closure cell. After the cell is backfilled and covered, three piezometers would be installed to allow periodic monitoring of groundwater levels within the closure cell. The piezometers would be developed in a manner which would preclude penetration of surface run-on or direct rainwater into the interior of the closure cell.

4-09. Cell Backfill and Cover. In order to achieve a uniform slope across the cell and allow for positive drainage from the cell surface, random fill material would be placed on the surface of the existing and relocated contaminated material. Approximately 14,000 cubic yards of this material would be required for the cell configuration illustrated on drawing 6. This material would be graded, compacted and then covered with a synthetic membrane having a minimum thickness of 20 mils, a 2-foot-thick layer of random fill material, and 6 inches of topsoil. The synthetic membrane would extend outside the slurry wall and french drains in order to provide a continuous impermeable barrier to divert rain water runoff from the cell surface directly to the perimeter runoff drainage ditches. This would prevent infiltration of surface water into the cell and thereby prevent downward migration of contaminants by eliminating the driving hydraulic head. The entire disturbed area would then be fertilized, tilled and seeded in order to establish a protective vegetation cover. Final grading around the cell perimeter would prevent run-on of surface water and would further route runoff water to the natural drainage ditch located north of the closure cell.

4-10. Rainwater Containment and Disposal. Construction of the slurry wall, french drain and runon control facilities, as previously described, would virtually eliminate site water problems during construction resulting from groundwater infiltration and inflow from surface waters. These facilities would not, however, eliminate accumulation of water from rainfall which falls within the limits of the runon control channels and levees. A sump area would be maintained during backfilling operations within the closure cell to provide positive drainage within the backfill. Water accumulating in this sump would be periodically tested and hauled to the industrial waste treatment plant for disposal if it is classified as being contaminated. This sump area would be dewatered and backfilled during a dry weather period just prior to installing the synthetic membrane, random fill and top soil in its immediate vicinity.

4-11. Operation and mainatenance. The site would remain closed to burning or surface debris disposal indefinitely and would require maintenance for a period of approximately 2 years to prevent erosion until vegetative growth is firmly established. Periodic inspections would be conducted thereafter to insure against potential erosion and settlement problems and to prevent deep root structure vegetation from establishing itself in the immediate vicinity of the closure cell. The site would be mowed according to the current arsenal moving schedule.

The perched water table level within the closure cell would be monitored periodically by means of the piezometers. If its level rises excessively, it would be tested and drawn down through the piezometers by means of portable pump facilities. This groundwater from perched water tables would be either discharged directly to the adjacent drainage ditch or transported to the industrial waste treament plan for treatment and disposal depending on whether or not it is classified as contaminated, based on test results.

One upgradient and 3 downgradient monitoring well pairs would be installed in the permanent and perched water tables at the site and sampled semiannually. The following parameter tests would be conducted:

Arsenic	Mercury	Iron
Barium	Selenium	Sodium
Cadmium	Silver	Sulfate
Chromium	Zinc	PH
Lead	Chloride	Specific conductance

V - ALTERNATIVE CLOSURE PLAN

5-01. General. This alternative plan evaluates the feasibility of moving the contaminated material at this site to a hazardous waste landfill. It has been estimated that 44,000 cubic yards of contaminated material exists at the site. After dewatering the excessively-wet material, all contaminated material would be hauled to the hazardous waste landfill. Use of the hazardous waste landfill would be necessary, since this material has hazardous waste characteristics and would be generated as RCRA wastes upon excavation.

The site would be backfilled, graded, topsoiled and seeded. Fill material and topsoil would be required to replace the contaminated material and fill the site as necessary to provide positive drainage to surrounding ditches. Consequently, approximately 93,000 cubic yards of off-site fill material would be required, of which 6,000 cubic yards would be topsoil and 87,000 cubic yards would be random fill material.

The hazardous waste landfill capacity required for this closure plan has been based on 61,000 cubic yards of material which allows for 15 percent overexcavation and a 20 percent volume increase to reflect the bulking which occurs during placement and recompaction.

VI - COSTS

6-01. General. Unit prices are based on those listed in the Concept Design Analysis, prepared by the Tulsa District and dated August, 1984. The cost estimates include an adjustment to January 1987 price levels. Where appropriate unit prices are not included in the referenced document, recently received bid prices and/or published unit cost data have been utilized.

6-02. Cost Comparason of Closure Plans. Table 6-1 presents a cost estimate for the proposed closure plan. Table 6-2 lists a cost estimate for an alternative off-site closure plan. This table is more general than table 6-1, but contains sufficient information to document the cost differential associated with the off-site closure alternative. Alternative plan costs are summarized as follows:

Proposed On-Site Closure Plan	$2,258,000
Off-Site Closure Plan, including Prorate Landfill Capacity Costs	$6,805,000

This comparison indicates a costing savings of $4,547,000 for the proposed closure plan.

TABLE 6-1
COST ESTIMATE
PROPOSED ON-SITE CLOSURE PLAN

Item	Unit	Unit Price 1/	Quantity	Estimated Cost
Clearing and Grubbing	AC	2200.00	16	$ 35,200
Relocate Sanitary Sewer	LS	--	LS	410,000
French Drain System:	--	--	--	--
Random Excav, Shored	CY	29.00	11,600	336,400
Piping, Filter Wrapped	LF	6.00	2,200	13,200
Sand Backfill	CY	14.50	3,900	33,480
Random Backfill (Stockpiled)	CY	3.60	9,300	33,480
Low Permeability Liner	CY	9.50	800	7,600
Pump Station, Complete	LS	--	LS	28,000
Slurry Wall	SF	5.80	28,000	162,400
Excavate and Place Contaminated Material	CY	6.50	1,400	9,100
Random Excavation	CY	3.60	12,300	44,280
Random Fill (Stockpiled)	CY	3.60	17,300	62,280
Random Fill (Borrow)	CY	8.75	40,000	350,000
Synthetic Membrane for Cell Cover	SF	0.90	296,000	266,400
Topsoil (6")	CY	8.75	12,900	112,875
Revegetation	SY	0.35	77,500	27,125
Erosion Control Fabric	SY	1.60	10,500	16,800
Groundwater Monitoring Wells	EA	6,000.00	8	48,000
Power Service to Pump Station	LS	--	LS	4,700
Dewater Closure Cell (Well Point System)	LS	--	LS	13,000
Plug 48" Culvert (Stokes Road)	LS	--	LS	1,000
Subtotal				$2,038,390
Contingencies @ 5%				$ 101,610
Subtotal				$2,140,000
Supervision and Inspecion (5.5%)				$ 118,000
Estimated Total Cost				$2,258,000

1/ Unit prices include 26.5% for overhead and profit and 15% for cost escalation to January 1987.

TABLE 6-2
COST ESTIMATE
ALTERNATIVE OFF-SITE CLOSURE PLAN

Item	Unit	Unit Price 1/	Quantity	Estimated Cost
Clearing and Grubbing	AC	2,200.00	7	$ 15,400.00
Relocate Sanitary Sewer	LS	--	LS	410,000.00
Excavate, Haul, Place, & Compact Contaminated Material	CY	12.50	61,000	762,500.00
Compacted Random Backfill	CY	8.75	87,000	761,250.00
Topsoil (6")	CY	8.75	6,000	52,500.00
Till, Fertilize and Seed	SY	0.35	33,000	11,550.00
Subtotal				$2,013,200.00
Contingencies @ 5%				$ 100,800.00
Subtotal				$2,114,000.00
Supervision and Inspection @ 5.5%				$ 116,000.00
Estimated Total Cost w/o Landfill Capacity 2/				$2,230,000.00

1/ Unit Prices include 26.5% for overhead and profit, and 15% for cost escalation to January 1987.

2/ Prorate landfill capacity cost for 61,000 cubuc yards is $4,575,000. Therefore, the total capital cost of ths alternative closure plan is $6,805,000.

EXHIBIT

EXHIBIT A

SITE PHOTOGRAPH

Looking southwest across Stokes Road at Site 24.
Stream and industrial sewer line are shown at left.

APPENDICES

APPENDIX I

LABORATORY, CHEMISTRY AND SOIL REPORTS

SWD LABORATORY REPORT 13755

SWDED-GL Report 13755

Table 1

Pine Bluff Arsenal
Site 24

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
5575	24-1	J-1	0.0- 1.0			1700				130		1200	
5576		J-2	1.0- 2.0	1.3	1.3	1900	300.0	3300.0	1.0	220	<0.1	1900	
5577		J-3	2.0- 3.0			1500				72		150	
5578		J-4	3.0- 6.0	0.8	2.7	110	190	880	<0.1	5.3	<0.1	10	
5579		J-5	6.0- 9.0	<0.5	15	97	<0.5	<5.0	<0.1	7.3	<0.1	8.9	
5580		J-6	9.0-12.0			38				4.8		8.7	
5581		J-7	12.0-15.0			23				4.1		6.2	
5582		J-8	15.0-16.0			30				5.0		7.0	
5583		J-9	16.0-17.5			33				4.0		5.9	
5584		J-10	17.5-20.5			32				2.5		6.8	
5597	24-2	J-4	3.0- 6.0			1500				120		40	
5598		J-5	6.0-10.0			75	0.9	7.5		9.0		9.9	
5600	24-3	J-1	0.0- 1.0			130	7.2	310		18000		1300	
5601		J-2	1.0- 2.0			1000				4400		770	
5602		J-3	2.0- ?			610				5000		2800	
5603		J-4	3.0- 5.0			7200				300		2800	
5604		J-5	5.0- 8.0			940	1200	130		33		65	
5605		J-6	8.0-10.0			450	320	26		13		15	
5609	24-4	J-4	3.5- 5.0			740	39	38		34		9.9	
5610		J-5	5.0- 8.0			490	2.7	24		22		5.3	
5611		J-6	8.0-11.0			370				23		5.9	
5616	24-5	J-5	3.0- 6.0			640	27	31		12		22.6	
5617		J-6	6.0- 6.5			1300	24	180		16		28	
5618		J-7	6.5-10.0			93				8.4		22	
5619	24-6	J-1	0.0- 1.0			810	9.9	130		21		19	
5623		J-5	6.0-10.0			<20				2.0		3.7	
5624	24-7	J-1	0.0- 1.0			2100				220		330	
5625		J-2	1.0- 2.0			1000				9.1		15	
5626		J-3	2.0- 3.0			1100				14		20	
5627		J-4	3.0- 5.0			680				4.0		8.1	
5629	24-8	J-1	0.0- 1.0			1400				170		66	
5630		J-2	1.0- 2.2			2400				340		39	
5631		J-3	2.2- 3.2			1300				9.9		8.1	
5632		J-4	3.2- 5.0			890				11		11	

Table 1 (Cont'd)

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
5633	24-9	J-1	0.0- 1.0			260				25		29	
5639	24-10	J-3	2.0- 3.0			750				32		35	
5641		J-5	4.5- 7.0			80				9.7		27	
5642		J-6	7.0-10.0			34				1.5		4.2	
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg.

SWDED-GL Report 13755

Table 2

Pine Bluff Arsenal
Site 24

Results of Chemical Analysis of Water[1]

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
5592	24-1	WS-1	Unknown	<0.01	0.077	16.75	0.88	0.03	<0.0001	0.40	<0.0004	1.12	
5593			4.6 WL	< 0.01	< 0.001	0.55	0.008	0.01	<0.0001	0.11	<0.0004	0.52	
5599	24-2	WS-1	0.0-10.0	< 0.01	< 0.001	21.00	0.003	0.03	<0.0001	0.04	<0.0004	0.17	
5628	24-7	WS-1	0.1-			0.57				0.06		0.19	
Minimum reported concentration				0.01	0.001	0.5	0.002	0.01	0.0001	0.01	0.0004	0.01	

(1) Results reported in mg/1.

SWDED-GL 13755

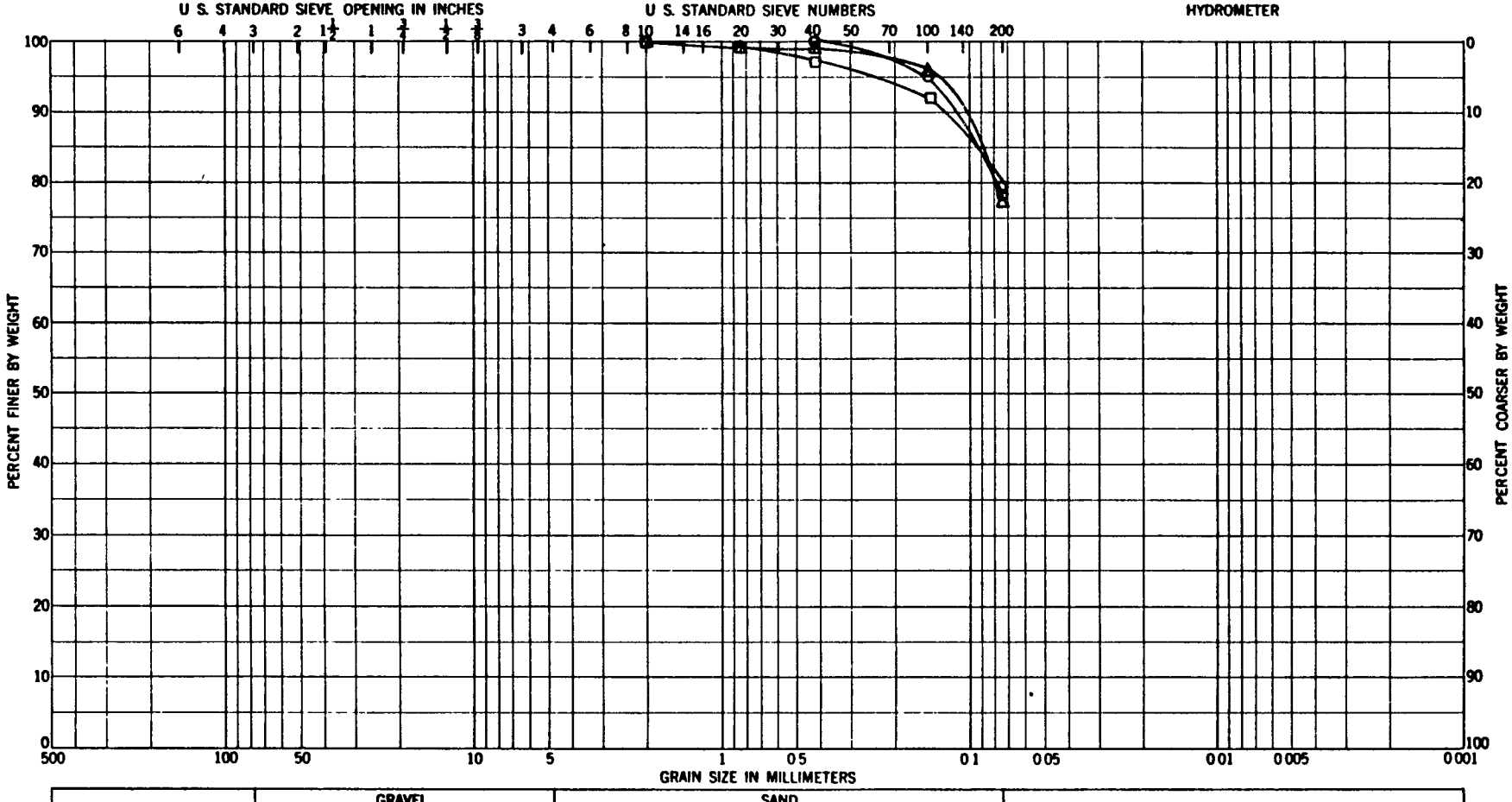
Table 1

Pine Bluff Arsenal
Site 24

Results of Tests of Disturbed Soil Samples

Boring No.	Field No.	SWD No.	Depth ft.	Mechanical Analysis			Atterberg Limits				Water Content %		Description
				Gr	Sa	Fi	LL	PL	PI	LS			
24-1	4	G-5578	3.0- 6.0	0	22	78	25	16	9		18.7	CL	CLAY, sandy, gray, moist.
	5	5579	6.0- 9.0	0	23	77	29	18	11		19.8	CL	CLAY, sandy, gray and yellow brown, moist.
	8	5582	15.0-16.0	0	21	79	29	14	15		19.6	CL	CLAY, sandy, gray, moist.
24-2	4	5597	3.0- 6.0	0	28	72	23	16	7		17.9	CL-ML	CLAY, sandy, gray, moist.
	5	5598	6.0-10.0	0	24	76	25	17	8		22.8	CL	CLAY, sandy, gray, moist.
24-3	5	5604	5.0- 8.0		-			-			-	ML	SILT, gray, moist.
	6	5605	8.0-10.0		-			-			-	ML	SILT, gray, moist.
24-4	4	5609	3.5- 5.0	2	35	63	23	16	7		19.9	CL-ML	CLAY, sandy, gray, moist.
24-5	5	5616	3.0- 6.0	0	27	73	31	14	17		22.2	CL	CLAY, sandy, gray, moist.
	7	5618	6.5-10.0	0	20	80	30	16	14		25.5	CL	CLAY, sandy, gray, moist.
24-6	1	5619	0.0- 1.0	0	49	51	31	14	17		18.6	CL	CLAY, sandy, gray, moist.
	2	5620	1.0- 2.0	0	68	32	22	16	6		14.2	SC-SM	SAND, clayey, yellow brown, moist.
24-10	3	5639	2.0- 3.0		-			-			-	CL	CLAY, sandy, gray, moist.
	5	5641	4.5- 7.0		-			-			-	CL	CLAY, gray, moist.
	6	5642	7.0-10.0		-			-			-	SM	SAND, silty, light gray, damp.

SWD LABORATORY REPORT 13755-1



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
G-5578 ○	3.0-6.0	CLAY, sandy (CL)	18.7	25	16	9
G-5579 △	6.0-9.0	CLAY, sandy (CL)	19.8	29	18	11
G-5582 □	15.0-16.0	CLAY, sandy (CL)	19.6	29	14	15

GRADATION CURVES

Project: Pine Bluff Arsenal

Area:

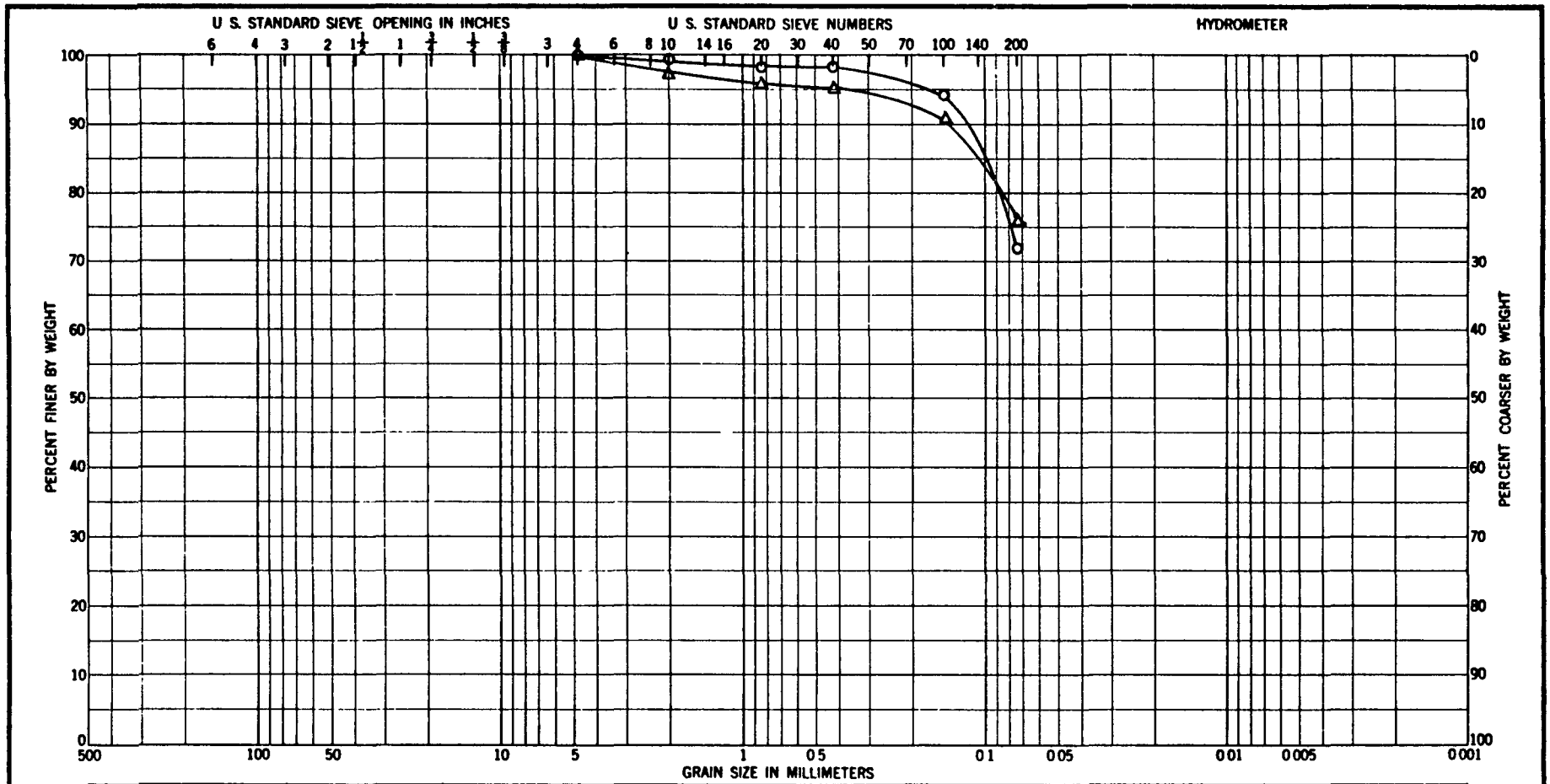
Boring No: 24-1

Date: April 84

SWED-GL Report No. 13755

Plate 1

ENG FORM 1 MAY 63 2087



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
G-5597 ○	3.0-6.0	CLAY, sandy (CL-ML)	17.9	23	16	7
G-5598 △	6.0-10.0	CLAY, sandy (CL)	22.8	25	17	8

GRADATION CURVES

Project: Pine Bluff Arsenal

Area:

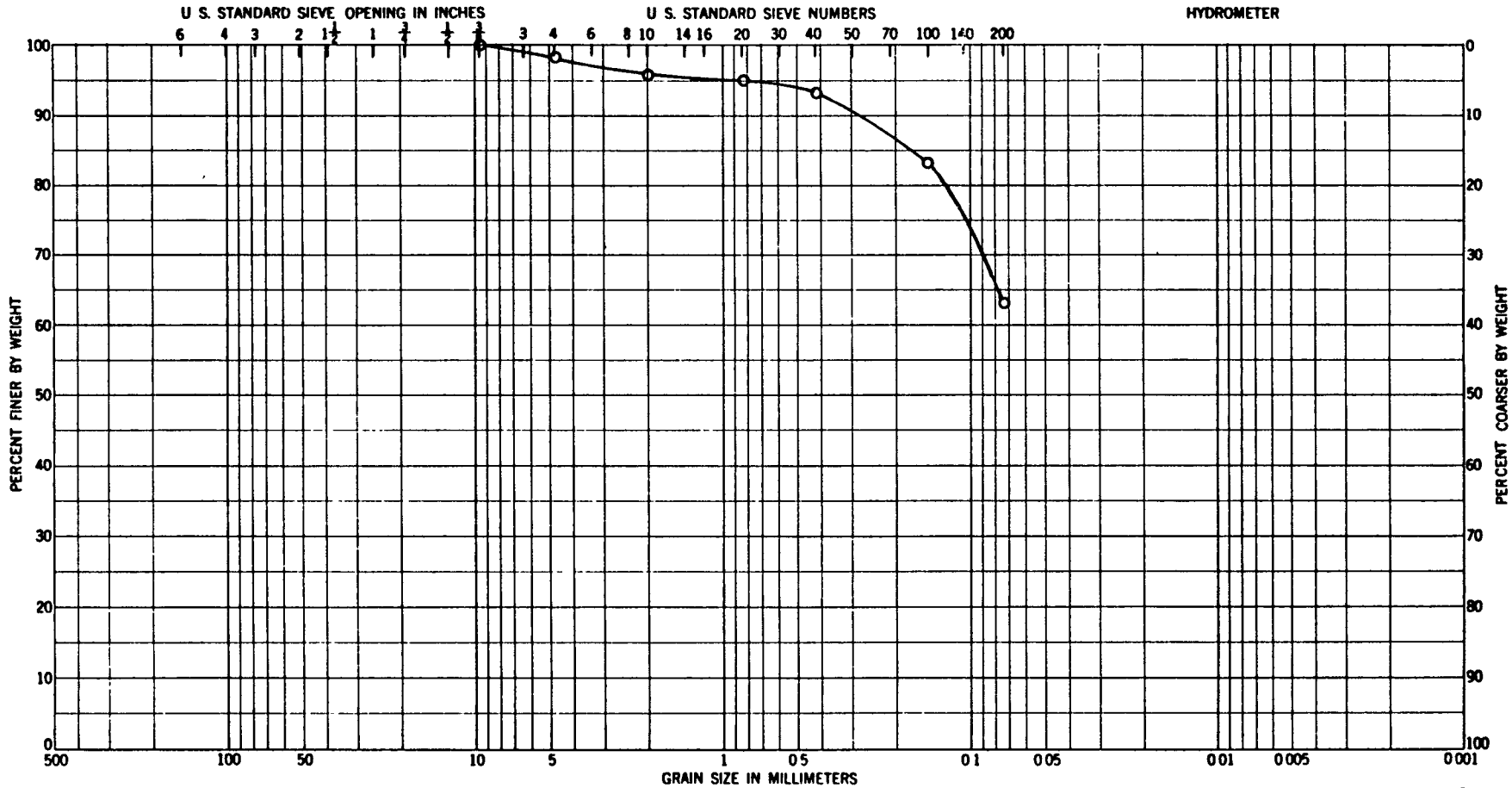
Boring No.: 24-2

Date: April 84

SWDED-GL Report No. 13755

Plate 2

ENG FORM 1 MAY 63 2087



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
G-5609	3.5-5.0	CLAY, sandy (CL-ML)	19.9	23	16	7

GRADATION CURVES

Project: Pine Bluff Arsenal

Area:

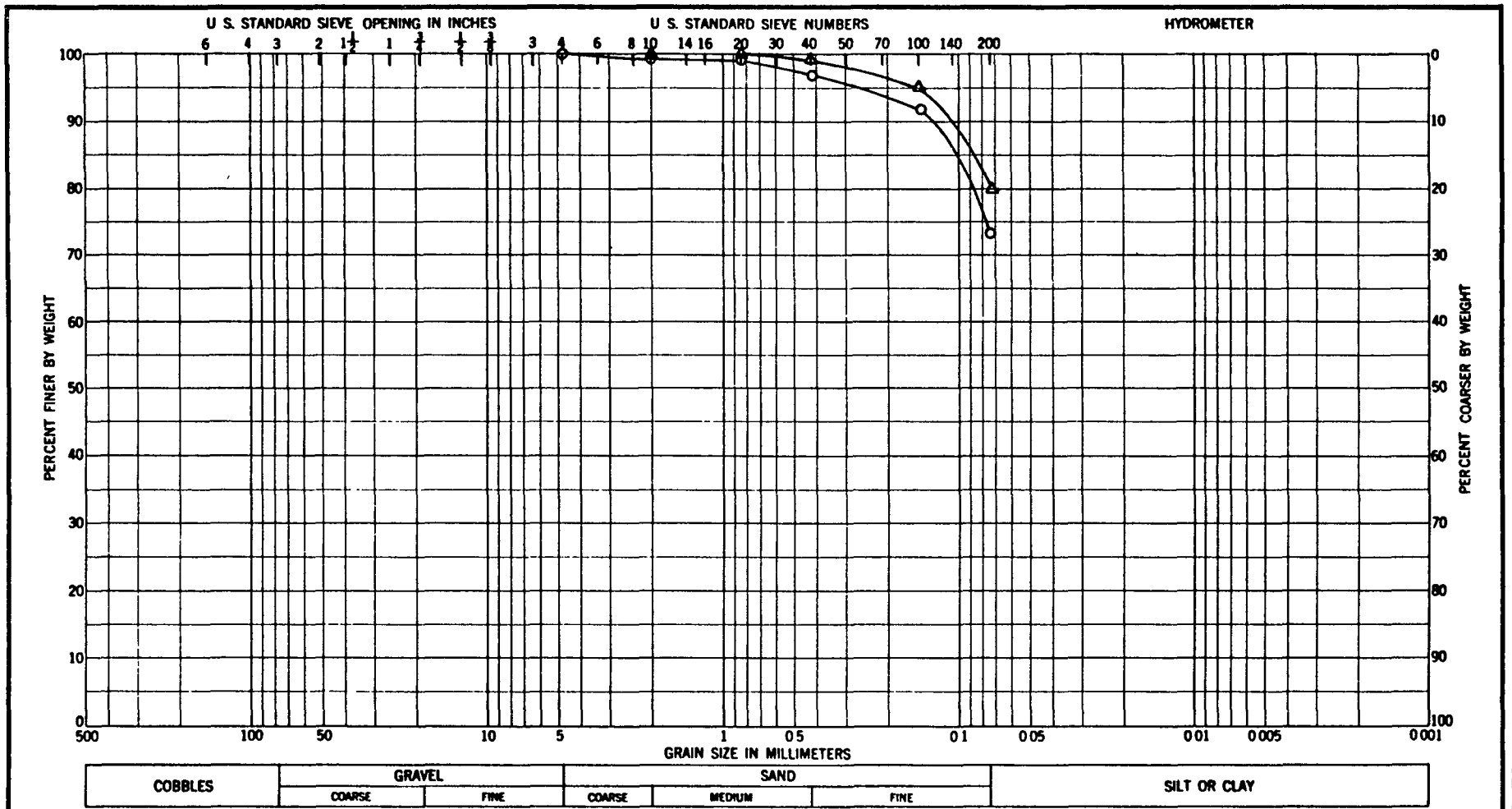
Boring No: 24-4

Date: April 84

SWDED-GL Report No. 13755

Plate 3

ENG FORM 1 MAY 63 2087



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
G-5616 ○	3.0-6.0	CLAY, sandy (CL)	22.2	31	14	17
G-5618 △	6.5-10.0	CLAY, sandy (CL)	25.5	30	16	14

GRADATION CURVES

Project: Pine Bluff Arsenal

Area:

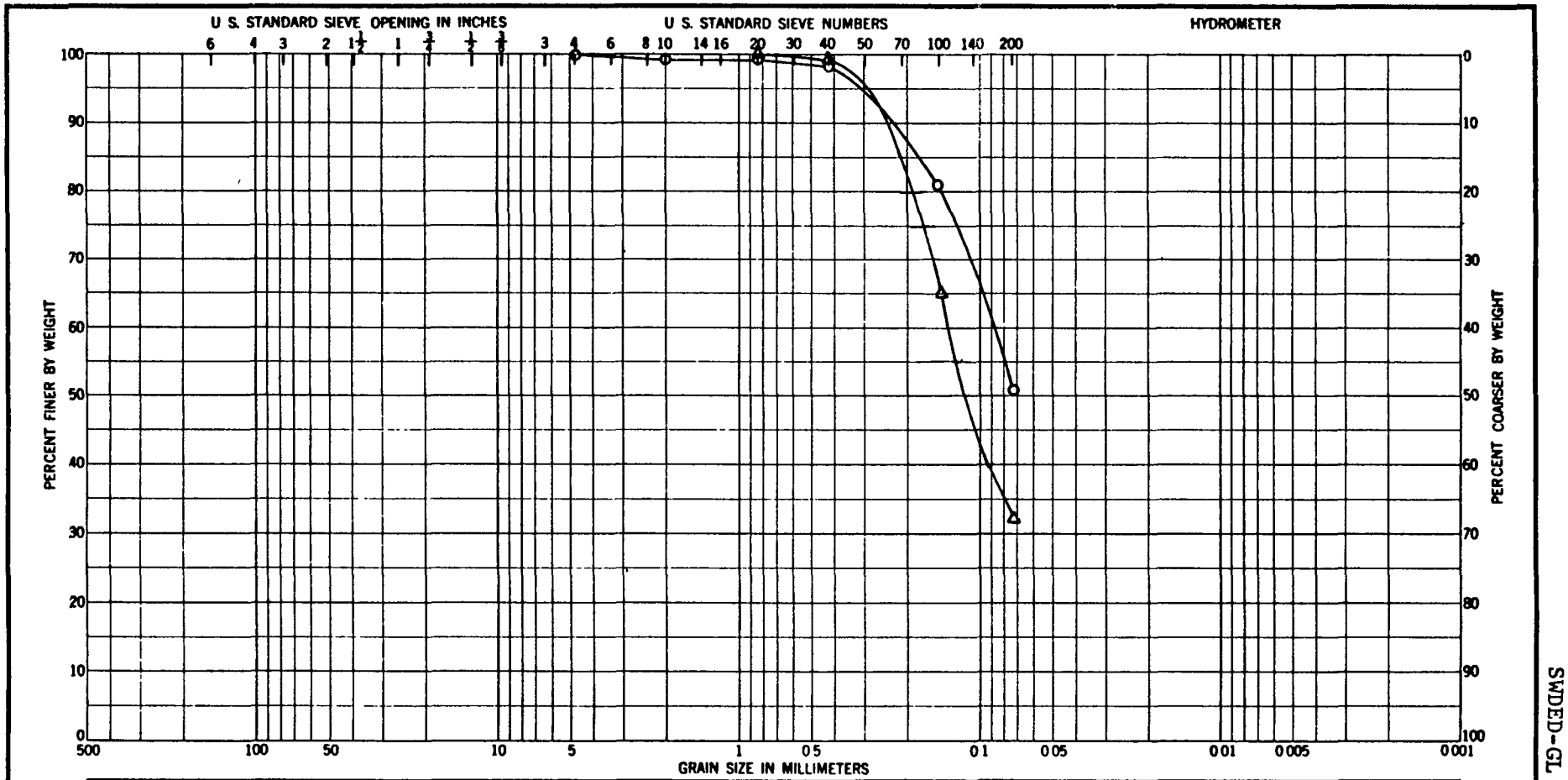
Boring No: 24-5

Date: April 84

SWDED-GL Report No. 13755

Plate 4

ENG FORM 1 MAY 63 2087



Sample No	Elev or Depth	Classfication	Nat w %	LL	PL	PI
G-5619 ○	0.0-1.0	CLAY, sandy (CL)	18.6	31	14	17
G-5620 △	1.0-2.0	SAND, clayey (SC-SM)	14.2	22	16	6

GRADATION CURVES

Project: Pine Bluff Arsenal

Area:

Boring No: 24-6

Date: April 84

SWDED-GL Report No. 13755

Plate 5

ENG FORM 1 MAY 63 2087

SWD LABORATORY REPORT 13755-2

SWDED-GL Report 13755-2

Table 1

Results of Chemical Analysis of Soil for EP Toxicity (1)

Pine Bluff Arsenal
Site 24

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se
5576	24-1	J-2	1.0-2.0	< 0.01	0.10	1.33	0.01	0.01	<0.0001	0.04	<0.0004
5578	24-1	J-4	3.0-6.0	< 0.01	0.09	<0.50	0.01	<0.01	<0.0001	0.04	<0.0004
5600	24-3	J-1	0.0-1.0	< 0.01	0.08	<0.50	0.05	<0.01	<0.0001	7.74	<0.0004
Minimum Reported Concentration				0.01	0.001	0.50	0.002	0.01	0.0001	0.01	0.0004
EP Toxicity Limits				5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0

(1) Results reported in mg/l

SWD LABORATORY REPORT 13755-3

SWDED-GL Report 13755-3

Table 1

Pine Bluff Arsenal
Site 24

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
5597	24-2	J-4	3.0-6.0				0.9	220					
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

Results reported in Mg/kg

SWD LABORATORY REPORT 13755-4

Results of Chemical Analysis of Soil(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
24-1	J-1	5575	0.0- 1.0				5.7	18					
	J-15	5589	30.0-33.0							3.0			
24-3	J-49	5603	3.0- 5.0				18	53					
24-6	J-2	5620	1.0- 2.0				0.8	13		6.1			
	J-3	5621	2.0- 4.5				0.5	<5.0		4.3			
24-9	J-2	5634	1.0- 2.0							7.1			
	J-3	5635	2.0- 3.0							7.5			
	J-4	5636	3.0- 4.0							6.4			
24-10	J-4	5640	3.0- 4.5							10			
24-11	J-1		0.0- 1.0				7.1	140		160			
	J-2	5644	1.0- 2.0				6900	260		23			
	J-3	5645	2.0- 3.0				16	14		6.9			
	J-4	5646	3.0- 6.0				<0.5	<5.0		1.6			
24-12	J-3	5649	2.0- 3.5							9.4			
	J-4	5650	3.5- 6.5							5.3			
Minimum reported concentration				**0.5**	**1.0**	**20.0**	**0.5**	**5.0**	**0.1**	**1.0**	**0.1**	**1.0**	

(1) Results reported in mg/kg

Results of Chemical Analysis of Soil for EP Toxicity(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se
24-1	J-2	5576	1.0- 2.0				0.008	0.004			
24-3	J-5	5604	5.0- 8.0				1.43	<0.01			
Minimum Reported Concentration				0.01	0.001	0.50	0.002	0.01	0.0001	0.01	0.0004
EP Toxicity Limits				5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0

(1) Results reported in mg/l.

SWD LABORATORY REPORT 13755-5

Results of Chemical Analysis of Soil[1]

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
24-14	J-3	6994	2.0- 3.0							250			
	J-4	6995	3.0- 6.5							47			
	J-5	6996	6.5-10.0							19			
24-15	J-3	6999	1.8- 2.8							110			
	J-4	7000	2.8- 4.8							14			
	J-5	7001	4.8- 7.5							220			
	J-6	7002	7.5-10.0							11			
24-16	J-3	7005	2.0- 3.0							12			
	J-4	7006	3.0- 4.5							13			
24-18	J-3	7016	2.0- 3.0							14			
	J-4	7017	3.0- 6.5							29			
	J-5	7018	6.5-10.0							1.0			
24-20	J-1	6947	0.0- 1.0							14			
	J-2	6948	1.0- 2.0							16			
	J-3	6949	2.0- 3.0							9.5			
	J-4	6950	3.0- 4.0							5.9			
	J-5	6951	4.0- 7.0							4.6			
	J-6	6952	7.0-10.0							3.1			
Minimum reported concentration				**0.5**	**1.0**	**20.0**	**0.5**	**5.0**	**0.1**	**1.0**	**0.1**	**1.0**	

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13755-6

Results of Chemical Analysis of Soil(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
24-21	J-1	6953	0.0- 1.0				< 0.5	<5.0		12			
	J-2	6954	1.0- 2.0				< 0.5	8.6		15			
24-13	J-1	6958					< 0.5	<5.0		9.2			
	J-2	6959	1.0- 2.0				< 0.5	< 5.0		6.9			
24-14	J-1	6992	0.0- 1.0							14000			
	J-2	6993	1.0- 2.0							6300			
24-15	J-1	6997	0.0- 0.6							1400			
	J-2	6998	0.6- 1.8							300			
24-16	J-1	7003	0.0- 1.0							16			
	J-2	7004	1.0- 2.0							23			
24-17	J-1	7009	0.0- 1.0							42			
	J-2	7010	1.0- 2.0							8.0			
	J-3	7011	2.0- 3.0							4.1			
	J-4	7012	3.0- 6.5							2.1			
24-18	J-1	7014	0.0- 1.0							830			
	J-2	7015	1.0- 2.0							320			
24-19	J-1	7019	0.0- 1.0							52			
	J-2	7020	1.0- 2.0							46			
	J-3	7021	2.0- 3.0							7.8			
	J-4	7022	3.0- 5.0							6.4			
Minimum reported concentration				**0.5**	**1.0**	**20.0**	**0.5**	**5.0**	**0.1**	**1.0**	**0.1**	**1.0**	

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13755-7

Results of Chemical Analysis of Soil[1]

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn
24-1	J-6	5580	9.0-12.0		<1.0							
	J-7	5581	12.0-15.0		<1.0							
24-4	J-6	5611	8.0-11.0				2.6	<5.0				
24-5	J-6	5617	6.0- 6.5				21	80				
24-6	J-2	5620	1.0- 2.0			59						
	J-3	5621	2.0- 4.5			<20.0						
24-7	J-1	5624	0.0- 1.0				330	2000				
	J-2	5625	1.0- 2.0				13	31				
	J-3	5626	2.0- 3.0				20	68				
	J-4	5627	3.0- 5.0				0.7	<5.0				
24-8	J-1	5628	0.0- 1.0				5.6	250				
	J-2	5630	1.0- 2.2				4.3	270				
	J-3	5631	2.2- 3.2				<0.5	9.1				
	J-4	5632	3.2- 5.0				<0.5	<5.0				
24-9	J-2	5634	1.0- 2.0			27	<0.5	<5.0				
	J-3	5635	2.0- 3.0			27	<0.5	<5.0				
	J-4	5636	3.0- 4.0			21	<0.5	<5.0				
24-10	J-3	5639	2.0- 3.0				1.4	20				
	J-4	5640	3.0- 4.5			520	0.9	51				
	J-5	5641	4.5- 7.0				<0.5	<5.0				
	J-6	5642	7.0-10.0				<0.5	<5.0				
24-11	J-1	5643	0.0- 1.0			7100						
	J-2	5644	1.0- 2.0			2400						
	J-3	5645	2.0- 3.0			180						
	J-4	5646	3.0- 6.0			<20.0						
24-12	J-3	5649	2.0- 3.5			24	4.7	<5.0				
	J-4	5650	3.5- 6.5			25	<0.5	<5.0				
24-13	J-1	6958	0.0- 1.0			<20.0						
	J-2	6959	1.0- 2.0			29						
Minimum reported concentration				**0.5**	**1.0**	**20.0**	**0.5**	**5.0**	**0.1**	**1.0**	**0.1**	**1.0**

(1) Results reported in mg/kg

Table 1 (Cont'd)

Results of Chemical Analysis of Soil(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
24-14	J-1	6992	0.0- 1.0			750	5.5	33					
	J-2	6993	1.0- 2.0			1300	2.0	480					
	J-3	6994	2.0- 3.0			62	<0.5	6.0					
	J-4	6995	3.0- 6.5			22	<0.5	<5.0					
	J-5	6996	6.5-10.0			<20.0	<0.5	<5.0					
24-15	J-1	6997	0.0- 0.6			65	7.8	480					
	J-2	6998	0.6- 1.8			310	1.2	41					
	J-3	6999	1.8- 2.8			49	<0.5	6.9					
	J-4	7000	2.8- 4.8			<20.0	<0.5	<5.0					
	J-5	7001	4.8- 7.5			120	<0.5	14					
	J-6	7002	7.5-10.0			<20.0	<0.5	<5.0					
24-16	J-1	7003	0.0- 1.0			<20.0	0.6	<5.0					
	J-2	7004	1.0- 2.0			<20.0	<0.5	6.2					
24-17	J-1	7009	0.0- 1.0			38	1.2	570					
	J-2	7010	1.0- 2.0			32	<0.5	12					
	J-3	7011	2.0- 3.0			<20.0	<0.5	<5.0					
	J-4	7012	3.0- 6.5			140	<0.5	<5.0					
24-18	J-1	7014	0.0- 1.0			1200	98	4900					
	J-2	7015	1.0- 2.0			5900	30	2300					
	J-3	7016	2.0- 3.0			730	2.3	110					
	J-4	7017	3.0- 6.5			2300	6.9	510					
	J-5	7018	6.5-10.0			190	<0.5	20					
24-19	J-1	7019	0.0- 1.0			220	33	220					
	J-2	7020	1.0- 2.0			530	27	180					
	J-3	7021	2.0- 3.0			81	0.7	6.2					
	J-4	7022	3.0- 5.0			52	<0.5	<5.0					
24-20	J-1	6947	0.0- 1.0			70	1.1	11					
	J-2	6948	1.0- 2.0			300	4.8	43					
	J-3	6949	2.0- 3.0			74	<0.5	5.5					
	J-4	6950	3.0- 4.0			23	<0.5	<5.0					
Minimum reported concentration				**0.5**	**1.0**	**20.0**	**0.5**	**5.0**	**0.1**	**1.0**	**0.1**	**1.0**	

(1) Results reported in mg/kg

Results of Chemical Analysis of Soil(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
24-20	J-5	6951	4.0- 7.0			26	< 0.5	<5.0					
	J-6	6952	7.0-10.0			<20.0	< 0.5	< 5.0					
24-21	J-1	6953	0.0- 1.0			160	0.7	<5.0		40			
	J-2	6954	1.0- 2.0			59	< 0.5	<5.0		23			
	J-3	6955	2.0- 3.0			39	< 0.5	<5.0		3.7			
	J-4	6956	3.0- 6.5			48	< 0.5	<5.0		6.4			
	J-5	6957	6.5-10.0			<20.0	< 0.5	<5.0		2.2			
24-22	J-1	7271	0.0- 2.0			21	< 0.5	<5.0		11			
	J-2	7272	2.0- 4.0			24	< 0.5	<5.0		8.6			
	J-3	7273	4.0- 5.0			40	< 0.5	<5.0		20			
24-23	J-1	7274	0.0- 1.0			<20.0	< 0.5	<5.0		15			
	J-2	7275	1.0- 2.0			21	< 0.5	<5.0		18			
	J-3	7276	2.0- 4.0			61	< 0.5	<5.0		21			
24-24	J-1	7278	0.0- 2.0			52	<0.5	<5.0		20			
	J-2	7279	2.0- 4.0			92	< 0.5	<5.0		18			
	J-3	7280	4.0- 5.0			89	< 0.5	<5.0		19			
24-25	J-1	7281	0.0- 1.0			320	4.1	37		25			
	J-2	7282	1.0- 2.0			120	1.2	13		24			
	J-3	7283	2.0- 3.0			220	0.7	5.6		24			
24-26	J-1	7286	0.0- 2.0			730	68	310		29			
	J-2	7287	2.0- 3.5			300	8.1	39		30			
	J-3	7288	3.5- 4.5			45	0.7	<5.0		13			
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13755-8

3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224

ALLIED ANALYTICAL & RESEARCH LABORATORIES

Chemists
Consultants & Technologists

214/337-8996

SAMPLE Soil

DATE SUBMITTED 8/21/84

IDENTIFYING MARKS 7473 , 24-33, 3.0'-5.0'

ANALYTICAL REPORT NO. 63281

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass St.
Dallas, TX 75255

ANALYSIS

U.S.E.P.A. Method 624

COMPOUND	MDL ppb	Conc ppb
Chloromethane	17	NA
Bromomethane	17	NA
Vinyl Chloride	17	NA
Chloroethane	17	NA
Methylene Chloride	5	NA
Trichlorofluoromethane	17	NA
1,1 Dichloroethylene	5	NA
1,1 Dichloroethane	9	NA
trans-1,2-Dichloroethylene	3	NA
Chloroform	3	NA
1,2 Dichloroethane	5	NA
1,1,1 Trichloroethane	7	NA
Carbon Tetrachloride	5	NA
Bromodichloromethane	3	NA
1,2 Dichloropropane	10	NA
trans-1,3-Dichloropropylene	9	NA
Trichloroethylene	3	NA
Dibromochloromethane	5	NA
cis-1,3-Dichloropropylene	17	NA
1,1,2 Trichloroethane	9	NA
Benzene	7	NA
2-Chloroethylvinylether	17	NA
Bromoform	9	NA
Tetrachloroethylene	7	NA
1,1,2,2 Tetrachloroethane	12	NA
Toluene	10	NA
Chlorobenzene	10	NA
Ethyl Benzene	12	NA
Acrolein	87	NA
Acrylonitrile	87	NA

NA = below minimum detectable level (MDL)

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3031 Glenfield
P.O. Box 24330
Dallas, Texas 75224

ALLIED ANALYTICAL & RESEARCH LABORATORIES

Chemists
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214/337-8996

SAMPLE Soil

DATE SUBMITTED 8/21/84

IDENTIFYING MARKS 7473, 24-33, 3.0'-5.0'

ANALYTICAL REPORT NO. 63281

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass St.
Dallas, TX 75255

ANALYSIS

Base-Neutral Extractables

COMPOUND	MDL,ppb	Conc.ppb
1,3 Dichlorobenzene	537	NA
1,4 Dichlorobenzene	1074	NA
Hexachloroethane	537	NA
1,2 Dichlorobenzene	537	NA
Bis(2-chloroisopropyl)ether	1611	NA
Hexachlorobutadiene	269	NA
1,2,4 Trichlorobenzene	537	NA
Naphthalene	537	NA
Bis (2-chloroethyl) Ether	1611	NA
Hexachlorocyclopentadiene	50	NA
Nitrobenzene	537	NA
Bis(2-chloroethoxy)Methane	1343	NA
2-Chloronaphthalene	537	NA
Acenaphthylene	1074	NA
Acenaphthene	537	NA
Isophorone	537	NA
Fluorene	537	NA
2,6 Dinitrotoluene	537	NA
1,2 Diphenylhydrazine	537	NA
2,4 Dinitrotoluene	1611	NA
n-Nitrosodiphenylamine	537	NA
Hexachlorobenzene	537	NA
4-Bromophenyl phenyl ether	537	NA
Phenanthrene	1343	NA

NA = Below minimum detectable level (MDL)

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IDENTIFYING MARKS 7473, 24-33, 3.0'-5.0'

ANALYTICAL REPORT NO. 63281

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass St.
Dallas, TX 75255

ANALYSIS

Base-Neutral Extractables

COMPOUND	MDL,ppb	Conc.ppb
Antharacene	537	NA
Dimethyl phthalate	537	NA
Diethyl phthalate	5908	NA
Fluoranthene	537	NA
Pyrene	537	NA
Di-n-butyl phthalate	437	514 ✓
Benzidene	8057	NA
Butyl benzyl phthalate	806	NA
Chrysene	806	NA
Bis(2-ethylhexyl)phthalate	806	NA
Benzo (a) anthracene	2149	NA
Benzo (b) fluoranthene	1343	NA
Benzo (k) fluoranthene	806	NA
Benzo (a) pyrene	806	NA
Indeno (1,2,3-cd) pyrene	1074	NA
Dibenzo (a,h) anthracene	806	NA
Benzo (g,h,i) perylene	1074	NA
n-Nitrosodimethylamine	100	NA
n-Nitrosodi-n-propylamine	537	NA
4-Chlorophenyl phenyl ether	1074	NA
3,3' Dichlorobenzidine	4566	NA
2,3,7,8 TCDD	8326	NA
Bis (chloromethyl) ether	1611	NA
Di-n-octyl phthalate	806	NA

NA = Below minimum detectable level (MDL)

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SAMPLE Soil

DATE SUBMITTED 8/21/84

IDENTIFYING MARKS 7473 , 24-33, 3.0'-5.0'

ANALYTICAL REPORT NO. 63281

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass St.
Dallas, TX 75255

ANALYSIS

U.S.E.P.A. Method 625
Acid Extractables

COMPOUND	MDL,ppb	Conc.ppb
2-Chlorophenol	806	NA
Phenol	537	NA
2,4 Dichlorophenol	806	NA
2-Nitrophenol	1074	NA
p-Chloro-m-Cresol	806	NA
2,4,6 Trichlorophenol	806	NA
2,4 Dimethylphenol	806	NA
2,4 Dinitrophenol	11280	NA
2-Methyl-4,6 Dinitrophenol	6446	NA
4-Nitrophenol	537	NA
Pentachlorophenol	1074	NA

NA = Below minimum detectable level (MDL)

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Dallas, Texas 75224

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SAMPLE Soil

DATE SUBMITTED 8/21/84

IDENTIFYING MARKS 7477, 24-33, 11.0'-12.5'

ANALYTICAL REPORT NO. 63281

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass St.
Dallas, TX 75255

ANALYSIS

U.S.E.P.A. Method 624

COMPOUND	MDL ppb	Conc ppb
Chloromethane	17	NA
Bromomethane	17	NA
Vinyl Chloride	17	NA
Chloroethane	17	NA
Methylene Chloride	5	NA
Trichlorofluoromethane	17	NA
1,1 Dichloroethylene	5	NA
1,1 Dichloroethane	9	NA
trans-1,2-Dichloroethylene	3	NA
Chloroform	3	NA
1,2 Dichloroethane	5	NA
1,1,1 Trichloroethane	7	NA
Carbon Tetrachloride	5	NA
Bromodichloromethane	3	NA
1,2 Dichloropropane	10	NA
trans-1,3-Dichloropropylene	9	NA
Trichloroethylene	3	NA
Dibromochloromethane	5	NA
cis-1,3-Dichloropropylene	17	NA
1,1,2 Trichloroethane	9	NA
Benzene	7	NA
2-Chloroethylvinylether	17	NA
Bromoform	9	NA
Tetrachloroethylene	7	NA
1,1,2,2 Tetrachloroethane	12	NA
Toluene	10	NA
Chlorobenzene	10	55 ✓
Ethyl Benzene	12	NA
Acrolein	86	NA
Acrylonitrile	86	NA

NA = below minimum detectable level (MDL)

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P.O. Box 24330
Dallas, Texas 75224

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SAMPLE Soil

DATE SUBMITTED 8/21/84

IDENTIFYING MARKS 7477, 24-33, 11.0'-12.5'

ANALYTICAL REPORT NO. 63281

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass St.
Dallas, TX 75255

ANALYSIS

Base-Neutral Extractables

COMPOUND	MDL,ppb	Conc.ppb
Antharacene	668	NA
Dimethyl phthalate	668	NA
Diethyl phthalate	7349	NA
Fluoranthene	668	NA
Pyrene	668	NA
Di-n-butyl phthalate	514	1522
Benzidene	10021	NA
Butyl benzyl phthalate	1002	NA
Chrysene	1002	NA
Bis(2-ethylhexyl)phthalate	1002	NA
Benzo (a) anthracene	2672	NA
Benzo (b) fluoranthene	1670	NA
Benzo (k) fluoranthene	1002	NA
Benzo (a) pyrene	1002	NA
Indeno (1,2,3-cd) pyrene	1336	NA
Dibenzo (a,h) anthracene	1002	NA
Benzo (g,h,i) perylene	1336	NA
n-Nitrosodimethylamine	100	NA
n-Nitrosodi-n-propylamine	668	NA
4-Chlorophenyl phenyl ether	1336	NA
3,3' Dichlorobenzidine	5678	NA
2,3,7,8 TCDD	10355	NA
Bis (chloromethyl) ether	2004	NA
Di-n-octyl phthalate	1002	NA

NA = Below minimum detectable level (MDL)

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3031 Glenfield
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SAMPLE Soil

DATE SUBMITTED 8/21/84

IDENTIFYING MARKS 7477 , 24-33, 11.0'-12.5'

ANALYTICAL REPORT NO. 63281

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass St.
Dallas, TX 75255

ANALYSIS

Base-Neutral Extractables

COMPOUND	MDL,ppb	Conc.ppb
1,3 Dichlorobenzene	668	NA
1,4 Dichlorobenzene	1336	NA
Hexachloroethane	668	NA
1,2 Dichlorobenzene	668	NA
Bis(2-chloroisopropyl)ether	2004	NA
Hexachlorobutadiene	334	NA
1,2,4 Trichlorobenzene	668	NA
Naphthalene	668	NA
Bis (2-chloroethyl) Ether	2004	NA
Hexachlorocyclopentadiene	50	NA
Nitrobenzene	668	NA
Bis(2-chloroethoxy)Methane	1670	NA
2-Chloronaphthalene	668	NA
Acenaphthylene	1336	NA
Acenaphthene	668	NA
Isophorone	668	NA
Fluorene	668	NA
2,6 Dinitrotoluene	668	NA
1,2 Diphenylhydrazine	668	NA
2,4 Dinitrotoluene	2004	NA
n-Nitrosodiphenylamine	668	NA
Hexachlorobenzene	668	NA
4-Bromophenyl phenyl ether	668	NA
Phenanthrene	1670	NA

NA = Below minimum detectable level (MDL)

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SAMPLE Soil

DATE SUBMITTED 8/21/84

IDENTIFYING MARKS 7477 , 24-33, 11.0'-12.5'

ANALYTICAL REPORT NO. 63281

SUBMITTED BY U.S.Army Corp of Engineers
Attn: Jeff Tye

ADDRESS 4815 Cass St.
Dallas, TX 75255

ANALYSIS

Acid Extractables

COMPOUND	MDL,ppb	Conc.ppb
2-Chlorophenol	1002	NA
Phenol	668	NA
2,4 Dichlorophenol	1002	NA
2-Nitrophenol	1336	NA
p-Chloro-m-Cresol	1002	NA
2,4,6 Trichlorophenol	1002	NA
2,4 Dimethylphenol	1002	NA
2,4 Dinitrophenol	14029	NA
2-Methyl-4,6 Dinitrophenol	8017	NA
4-Nitrophenol	668	NA
Pentachlorophenol	1336	NA

NA = Below minimum detectable level (MDL)

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY H Thomas Miller

SWD LABORATORY REPORT 13755-9

Table 1

Pine Bluff Arsenal
Site 24

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
5604	24-3	J-5	5.0-8.0			590	390	680		1500			
				NOTE: Rerun of tests previously reported.									
7378	24-3A	J-1	10.0-14.5			1300	330	200		180		240	
7379		J-2	12.0-14.5			1200	560	800		2000		300	
7380		J-3	14.5-17.0			460	30	59		41		23	
7381		J-4	17.0-20.0			25	<0.5	4.7		10		8.5	
7382	24-4A	J-1	10.0-12.5			46	<0.5	6.1		10		3.6	
7383		J-2	12.5-15.5			76	0.7	14		22		6.9	
7384		J-3	15.5-18.5			41	<0.5	2.5		8.6		5.8	
5618	24-5	J-7	6.5-10.0				0.5	5.3					
		J-8	Not Received										
		J-9	Not Received										
7283	24-25	J-3	2.0-3.0							31			
7284		J-4	3.0-4.0			200	0.6	8.7		24			
7285		J-5	4.0-6.0			40	<0.5	<5.0		2.4			
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

Table 1 Cond't

Pine Bluff Arsenal
Site 24

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
7417	24-27	J-5	4.5-7.8			830	1500	110		13			
7418		J-6	7.5-9.5			140	3.7	21		26			
7419		J-7	9.5-12.5			570	3.5	30		25			
7420		J-8	12.5-15.5			38	1.0	<5.0		6.2			
7426	24-28	J-4	3.0-6.0			260	1.6	38		15			
7427		J-5	6.0-9.0			160	0.9	27		13			
7428		J-6	9.0-11.5			44	0.6	6.8		4.8			
7429		J-7	11.5-14.5			<20	0.5	24		3.4			
7435	24-29	J-4	3.0-6.0			290	560	75		18			
7436		J-5	6.0-9.0			800	7.9	280		54			
7437		J-6	9.0-12.2			26	<0.5	5.8		4.9			
7438		J-7	12.2-15.2			<20	<0.5	3.5		3.7			
7445	24-30	J-5	4.0-7.0			61	<0.5	14		8.3			
7446		J-6	7.0-10.0			14	<0.5	<5.0		2.5			
7447		J-7	10.0-13.0			51	<0.5	9.9		2.2			
7448		J-8	13.0-15.0			<20	<0.5	<5.0		2.3			
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
7454	24-31	J-1	0.0-2.0			2300	15	520		15000			
7455		J-2	2.0-4.0			1800	27	1000		290			
7456		J-3	4.0-5.0			740	390	220		250			
7457		J-4	5.0-9.0			230	28	83		58			
7458		J-5	9.0-10.5			360	290	170		170			
7459		J-6	10.5-13.5			200	170	24		85			
7460		J-7	13.5-15.5			37	0.9	69		7.1			
7461		J-8	15.5-16.0			55	5.6	15		26			
7462		J-9	16.0-20.0			31	0.9	< 5.0		10			
7467	24-32	J-5	8.0-10.0			32	1.2	< 5.0		9.0			
7468		J-6	10.0-13.0			< 20	0.7	< 5.0		41.0			
7469		J-7	13.0-16.0			< 20	0.6	< 5.0		4.6			
7470		J-8	16.0-20.0			< 20	< 0.5	< 5.0		3.9			
7476	24-33	J-6	9.5-11.0			340	610	700		80			
7477		J-7	11.0-12.5			1100	960	810		24			
7478		J-8	12.5-15.5			50	1.2	< 5.0		4.4			
7479		J-9	15.5-17.0			< 20	1.1	< 5.0		1.6			
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
7480	24-33	J-10	17.0-20.0			∠20	∠0.5	∠5.0		3.0			

Minimum Reported Concentration	0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13755-10

SWDED-GL Report 13755-10 Table 1 Pine Bluff Arsenal
Site 24

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
7621	7A	J-1	0.0 - 1.0			310	6.4	67		9.6			
7623		J-3	2.0 - 3.0			1200	0.9	13		5.7			
7625		J-5	5.5 - 8.5			740	<0.5	6.1		4.1			
7627		J-7	11.5 - 15.0			110	<0.5	<5.0		5.0			
7628	34	J-1	0.0 - 1.0			540	25	310		39			
7630		J-3	2.0 - 3.0			380	4.1	2.7		1.6			
7632		J-5	4.5 - 7.5			81	0.7	5.9		5.3			
7635		J-8	12.5 - 15.0			22	<0.5	4.7		7.9			
7636	35	J-1	0.0 - 1.0			320	69	240		26			
7638		J-3	2.0 - 3.2			230	8.5	990		29			
7640		J-5	6.2 - 7.3			210	7.7	1400		44			
		J-7	Sample not received										
7641	36	J-1	0.0 - 1.0			270	7.2	170		9.9			
7643		J-3	2.0 - 3.0			41	0.8	6.5		11			
7645		J-5	6.0 - 9.0			580	0.5	5.6		6.9			
7647		J-7	12.0 - 15.0			320	0.6	4.9		8.6			
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

Table 1 Cond't

Results of Chemical Analysis of Soil(1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
7549	37	J-1	0.0 - 1.0			240	1.1	670		36			
7551		J-3	2.0 - 3.0			94	<0.5	64		4.0			
7553		J-5	6.2 - 9.2			34	<0.5	5.3		3.3			
7555		J-7	12.0 - 15.0			65	<0.5	6.7		8.2			
7556	38	J-1	0.0 - 1.0			440	0.9	800		120			
7558		J-3	2.0 - 3.0			760	<0.5	29		11			
7560		J-5	4.5 - 6.0			31	<0.5	3.1		6.6			
7562		J-7	8.0 - 11.0			98	<0.5	4.5		7.6			
7564		J-9	12.5 - 15.0			47	<0.5	4.7		7.0			
7565	39	J-1	0.0 - 1.0			260	<0.5	45		15			
7566		J-2	1.0 - 2.0			110	<0.5	36		12			
7568		J-4	3.0 - 6.0			130	<0.5	14		11			
7570		J-6	9.0 - 10.5			54	<0.5	4.7		8.8			
7572		J-8	13.5 - 15.0			35	<0.5	3.9		8.7			
7648	40	J-1	0.0 - 0.6			200	24	440		58			
7650		J-3	2.0 - 3.0			15	27	160		2.7			
7652		J-5	5.0 - 7.0			1500	1.0	9.3		9.4			
7654		J-7	10.0 - 13.0			290	0.7	2.6		6.0			
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13755-11

Table 1

Results of Chemical Analysis of Soil[1]

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
2	J-2	G/ 5595	1.0- 2.0			2400	11	9700		3500			
	J-4	5597	3.0- 6.0			1000	1.2	450		210			
3	J-2	5601	1.0- 2.0			97	23	2000		6800			
	J-8	7379	12.0-14.5			580	250	940		2100			
4	J-2	5607	1.0- 2.0			990	27	4100		16000			
	J-4	5609	3.5- 5.5			1100	100	740		480			
5	J-2	5613	0.5- 1.0			55	6.1	12		10			
	J-6	5617	6.0- 6.5			860	88	3400		29			
6	J-1	5619	0.0- 1.0			1200	46	320		59			
7	J-1	5624	0.0- 1.0			640	21	2700		180			
	J-3	5626	2.0- 3.0			220	15	89		11			
8	J-2	5630	1.0- 2.2			480	4.8	950		260			
11	J-2	5644	1.0- 2.0			1600	15000	730		21			
	J-3	5645	2.0- 3.0			310	28	99		15			
14	J-1	6931	0.0- 1.2			67	< 0.5	< 5.0		6.7			
	J-2	6932	1.2- 2.2			83	< 0.5	< 5.0		6.5			
	J-3	6933	2.2- 3.2			< 20	< 0.5	< 5.0		3.1			
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

Results of Chemical Analysis of Soil(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
18	J-1	7014	0.0- 1.0			2100	90	7000		140			
	J-4	7017	3.0- 6.5			1200	8.3	1200		37			
27	J-2	7414	1.0- 2.0			740	33	3800		1800			
	J-5	7417	4.5- 7.5			530	810	40		140			
31	J-2	7455	2.0- 4.0			850	60	6400		390			
	J-4	7457	5.0- 9.0			96	52	43		89			
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

Table 2

Results of Chemical Analysis of Soil for EP Toxicity(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se
2	J-2	G/ 5595	1.0-2.0	0.06	0.001	42	0.043	0.57	0.0003	3.1	<0.004
	J-4	5597	3.0- 6.0	<0.01	<0.001	4.0	0.013	0.33	0.0001	0.10	<0.004
3	J-2	5601	1.0- 2.0	<0.01	<0.001	<0.50	0.293	0.13	<0.0001	69	<0.004
	J-8	7379	12.0-14.5	<0.01	0.001	8.7	17	1.2	0.0001	33	<0.004
4	J-2	5607	1.0- 2.0	<0.01	<0.001	12	0.355	0.30	0.0002	260	<0.004
	J-4	5609	3.5- 5.5	<0.01	<0.001	3.6	0.763	0.54	0.0003	0.27	<0.004
5	J-2	5613	0.5- 1.0	<0.01	<0.001	<0.50	0.120	<0.01	0.0001	<0.01	<0.004
	J-6	5617	6.0- 6.5	<0.01	<0.001	<0.50	0.825	0.23	<0.0001	<0.01	<0.004
6	J-1	5619	0.0- 1.0	<0.01	<0.001	2.9	0.200	0.27	<0.0001	0.02	<0.004
7	J-1	5624	0.0- 1.0	<0.01	<0.001	5.9	4.1	0.12	<0.0001	0.07	<0.004
	J-3	5626	2.0- 3.0	<0.01	<0.001	1.5	0.300	<0.01	<0.0001	0.06	<0.004
8	J-2	5630	1.0- 2.2	<0.01	0.004	<0.50	0.078	0.01	<0.0001	0.15	<0.004
11	J-2	5644	1.0- 2.0	<0.01	<0.001	17	12	0.21	<0.0001	0.05	<0.004
	J-3	5645	2.0- 3.0	<0.01	0.002	1.3	0.205	0.24	0.0001	0.08	<0.004
Minimum Reported Concentration				0.01	0.001	0.50	0.002	0.01	0.0001	0.01	0.0004
EP Toxicity Limits				5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0

(1) Results reported in mg/l.

Results of Chemical Analysis of Soil for EP Toxicity(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se
14	J-1	6931	0.0-1.2	< 0.01	< 0.001	< 0.50	< 0.002	< 0.01	0.0002	0.08	< 0.004
	J-2	6932	1.2-2.2	< 0.01	< 0.001	< 0.50	0.005	< 0.01	< 0.0001	0.09	< 0.004
	J-3	6933	2.2-3.2	< 0.01	< 0.001	< 0.50	0.003	< 0.01	0.0002	0.09	< 0.004
18	J-1	7014	0.0-1.0	< 0.01	< 0.001	41	0.908	0.19	< 0.0001	0.10	< 0.004
	J-4	7017	3.0-6.5	< 0.01	< 0.001	9.5	0.060	0.14	< 0.0001	0.04	< 0.004
27	J-2	7414	1.0-2.0	< 0.01	< 0.001	3.9	0.248	0.91	< 0.0001	4.9	< 0.004
	J-5	7417	4.5-7.5	< 0.01	< 0.001	11	29	< 0.01	< 0.0001	0.07	< 0.004
31	J-2	7455	2.0-4.0	< 0.01	< 0.001	3.0	0.31	0.04	< 0.0001	0.08	< 0.004
	J-4	7457	5.0-9.0	< 0.01	< 0.001	< 0.50	0.758	< 0.01	< 0.0001	0.04	< 0.004
Minimum Reported Concentration				0.01	0.001	0.50	0.002	0.01	0.0001	0.01	0.0004
EP Toxicity Limits				5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0

(1) Results reported in mg/l.

SWD LABORATORY REPORT 13755-12

SWDED-GL Report 13755-12

Table 1

Pine Bluff Arsenal
Site 24

Results of Chemical Analysis of Soil for EP Toxicity(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se
24-3	J-9			Sample not received at SWD Lab.							
" 3A	J-3	7380	14.5-17.0	<0.01	0.001	1.33	0.273	<0.01	0.0001	0.04	<0.0004
" 15	J-5	7001	4.8-7.5	<0.01	0.001	<0.50	0.005	<0.01	<0.0001	0.15	<0.0004
" 17	J-1	7009	0.0-1.0	<0.01	0.002	0.76	0.005	0.39	<0.0001	0.04	<0.0004
" 21	J-3	6955	2.0-3.0	<0.01	<0.001	<0.50	<0.002	<0.01	<0.0001	0.01	<0.0004
" 26	J-2	7287	2.0-3.5	<0.01	<0.001	0.67	0.095	0.77	<0.0001	0.02	<0.0004
" 30	J-5	7445	4.0-7.0	<0.01	<0.001	<0.50	0.015	0.17	<0.0001	0.02	<0.0004
" 34	J-4	7631	3.0-4.5	<0.01	<0.001	0.62	0.013	0.04	<0.0001	0.04	<0.0004
" 36	J-5	7645	6.0-9.0	<0.01	<0.001	2.19	0.005	<0.01	0.0001	0.03	<0.0004

Minimum Reported Concentration	0.01	0.001	0.50	0.002	0.01	0.0001	0.01	0.0004
EP Toxicity Limits	5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0

(1) Results reported in mg/l.

SWD LABORATORY REPORT 13755-13

SWDED-GL Report 13755

Table 1

Pine Bluff Arsenal
Site 24

Results of Chemical Analysis of Water[1]

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
24	J-1	9058		<0.01	<0.001	<0.50	0.010	0.02	0.0006	0.11	0.0009		
Minimum Reported Concentration				0.01	0.001	0.50	0.002	0.01	0.0001	0.01	0.0004	0.01	

(1) Results reported in mg/l.

SWD LABORATORY REPORT 13755-14

SWDED-GL Report 13755

Table 1

Pine Bluff Arsenal
Site 24

Results of Chemical Analysis of Soil for EP Toxicity(1)

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se
24-3A	J-4	7381	17.0-20.0			< 0.50	0.005	< 0.01		0.07	
24-26	J-3	7288	3.5-4.5			< 0.50	0.015	< 0.01		0.02	
Minimum Reported Concentration				0.01	0.001	0.50	0.002	0.01	0.0001	0.01	0.0004
EP Toxicity Limits				5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0

(1) Results reported in mg/l.

SWD LABORATORY REPORT 13755-15

Table 1

Results of Chemical Analysis of Soil[1]

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	pH
24-41	J-1	9181	0.0-2.7			35	<0.5	10		14			3.7
	J-2	9182	2.7-3.2			46	<0.5	9.9		11			3.7
	J-3	9183	4.8-5.3			<20	<0.5	6.5		7.4			3.8
	J-4	9184	7.0-7.5			<20	<0.5	<5.0		4.3			4.1
	J-5	9185	9.4-9.9			<20	<0.5	7.2		8.5			3.9
	J-6	9186	11.7-12.2			<20	<0.5	<5.0		4.7			4.4
24-43	J-1	9118	0.0-1.5			58	<0.5	7.7		9.1			3.6
	J-2	9119	1.5-4.5			80	<0.5	11		13			4.0
	J-3	9120	4.4-7.5			40	<0.5	6.5		7.6			4.1
	J-4	9121	7.5-10.5			<20	<0.5	<5.0		5.6			4.0
	J-5	9122	10.5-12.5			<20	<0.5	<5.0		6.4			4.1
	J-6	9123	12.5-14.8			59	<0.5	10		11			4.2
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

SWD LABORATORY REPORT 13755-17

Table 1

Results of Chemical Analysis of Soil[1]

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn	
24-51	J-1	9357	0.0-3.0			<20.0	<0.5	4.4		6.3			
	J-3	9359	6.0-9.0			45	<0.5	3.3		3.1			
	J-5	9361	11.5-15.0			<20.0	<0.5	3.4		3.8			
	J-7	9363	18.0-20.5			<20.0	<0.5	2.5		3.4			
24-52	J-1	9364	0.0-3.0			<20.0	<0.5	5.9		6.7			
	J-3	9366	6.0-9.0			<20.0	<0.5	4.7		5.1			
	J-5	9368	10.5-13.5			<20.0	<0.5	5.9		4.2			
	J-7	9370	17.0-20.5			<20.0	<0.5	3.8		4.4			
24-53	J-1	9371	0.0-3.0			<20.0	<0.5	4.3		7.0			
	J-3	9373	6.0-9.0			<20.0	<0.5	3.2		5.0			
	J-5	9375	12.0-15.0			<20.0	<0.5	3.1		4.9			
	J-7	9377	18.0-20.5			<20.0	<0.5	2.4		2.7			
Minimum reported concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0	

(1) Results reported in mg/kg

APPENDIX II

BORING - CONTAMINANT PLOTS

LEGEND

CONTAMINATED DEBRIS AND RUBBLE

SAND AND GRAVEL

SILT AND SANDY CLAY

CLAY

CLAY SHALE OR SILTSTONE
OF THE JACKSON GROUP

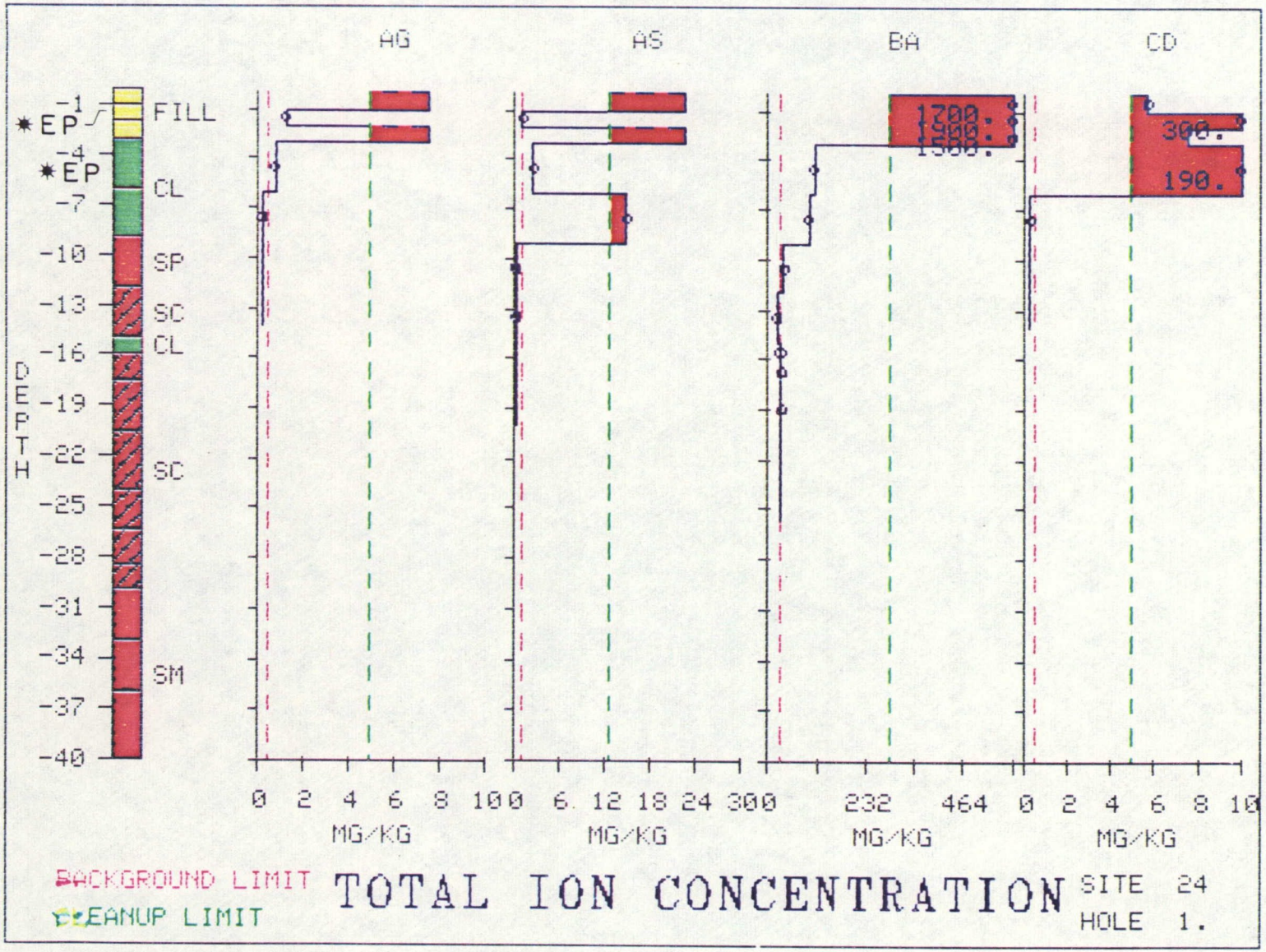
SAND OR POORLY CEMENTED SANDSTONE
OF THE JACKSON GROUP

MIDDEPTH OF SOIL SAMPLE TESTED

BACKGROUND LIMIT — Average concentration of contaminant in soil at Pine Bluff Arsenal. (or minimum detectable value)

CLEANUP LIMIT — Concentration to which site will be cleaned up (10 times background limit). The color "red" to the right of the cleanup limit indicates contamination.

*EP — LOCATION OF SAMPLE TESTED FOR EP TOXICITY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CL
SC
SM
DEPTH
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-16
-19
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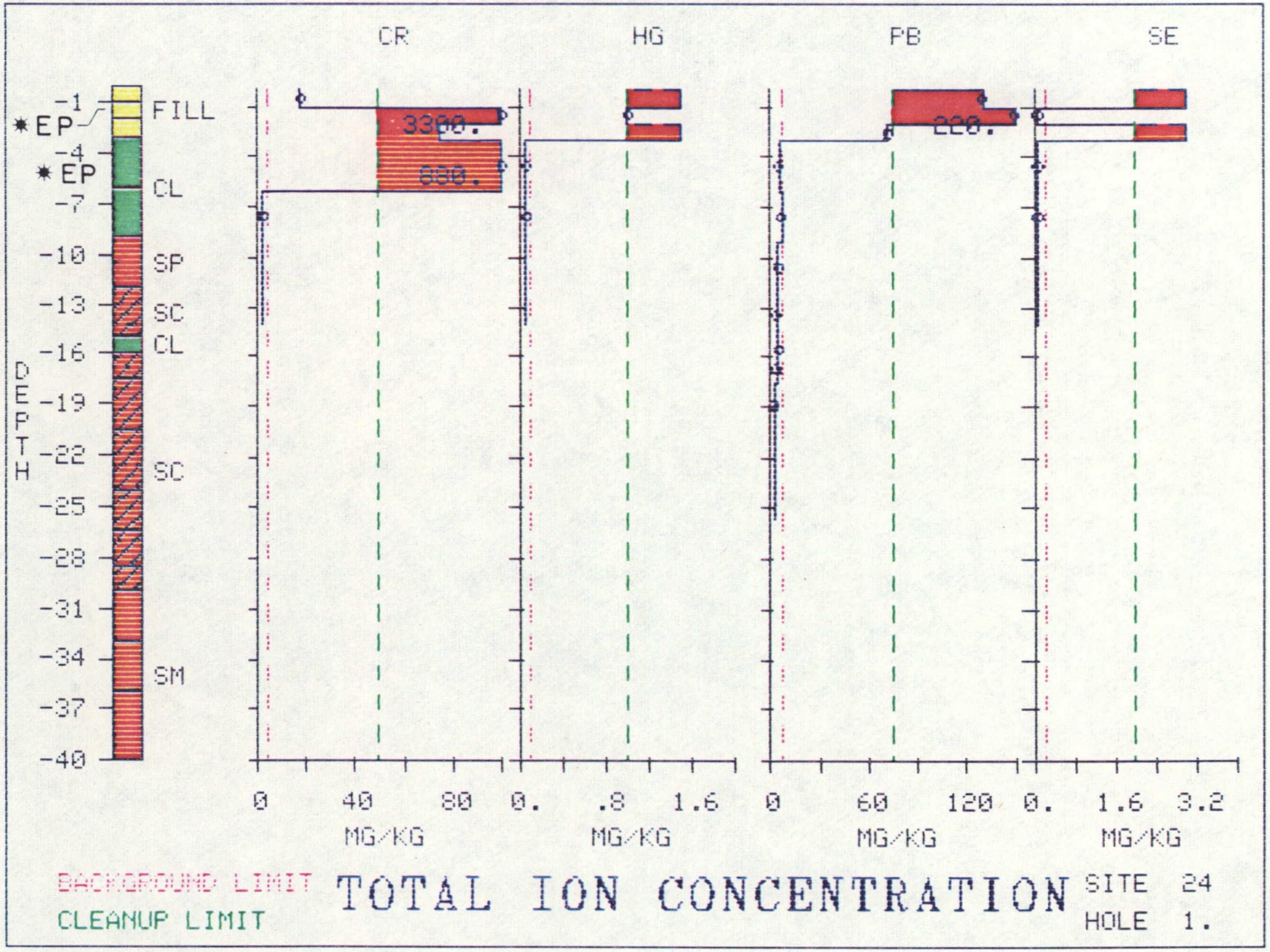
-25
-28
-31
-34
-37
-40
1700.
1500.
1500.
300.
190.
0 2 4 6 8 10
0 6. 12 18 24 30
232 464
0 2 4 6 8 10
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 1.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-34
-37
-40
DEPTH
FILL
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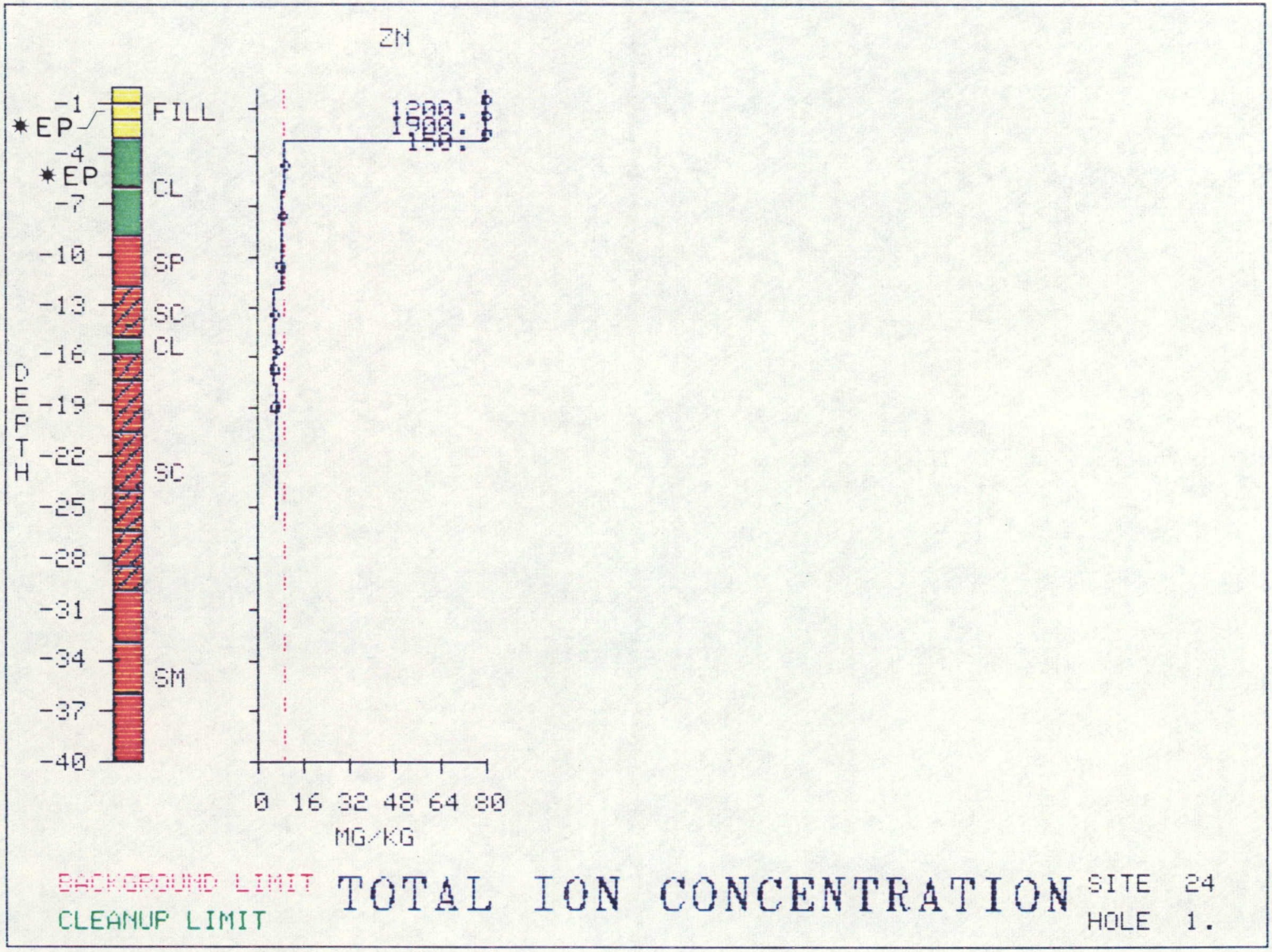
SP
SC
CL
SC
SM
3300.
830.
220.
0
40
80
0.
.8
1.6
0
60
120
0.
1.6
3.2
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 1.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DEPTH
FILL
CL
SP
SC
CL
SC
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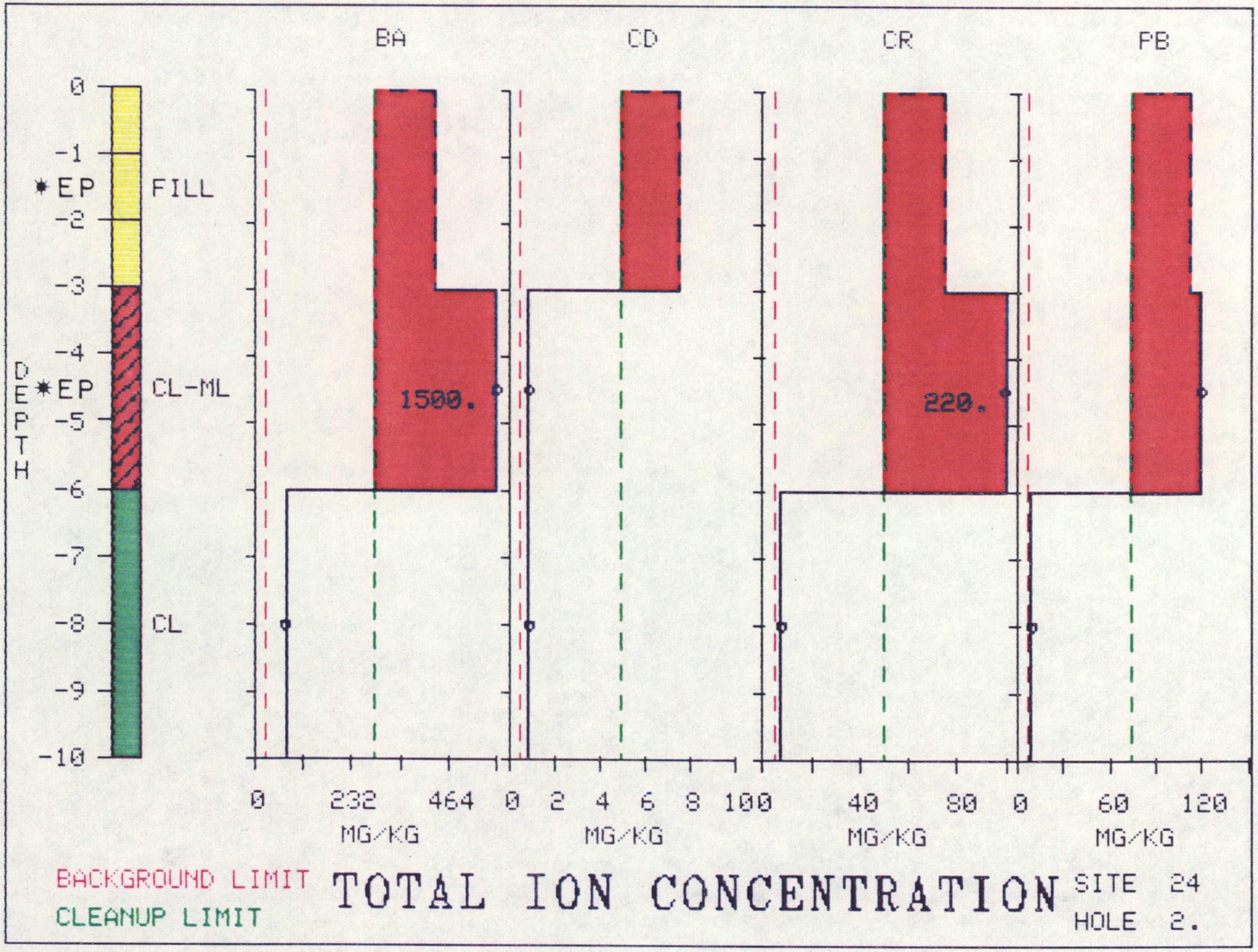
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 1.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-8
CL
-9
-10
1500.
220.
0
232
464
0
2
4
6
8
100
40
80
0
60
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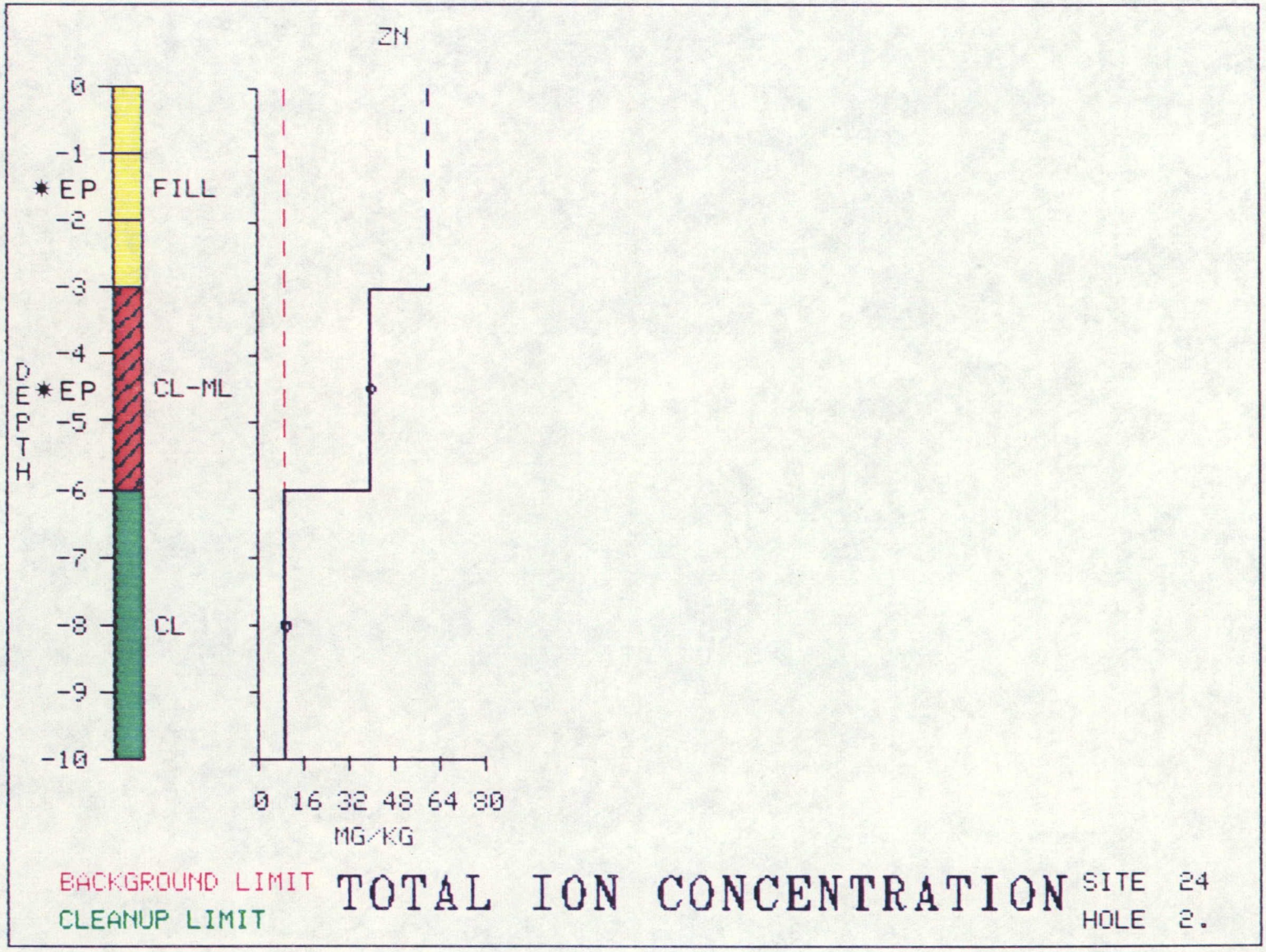
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 2.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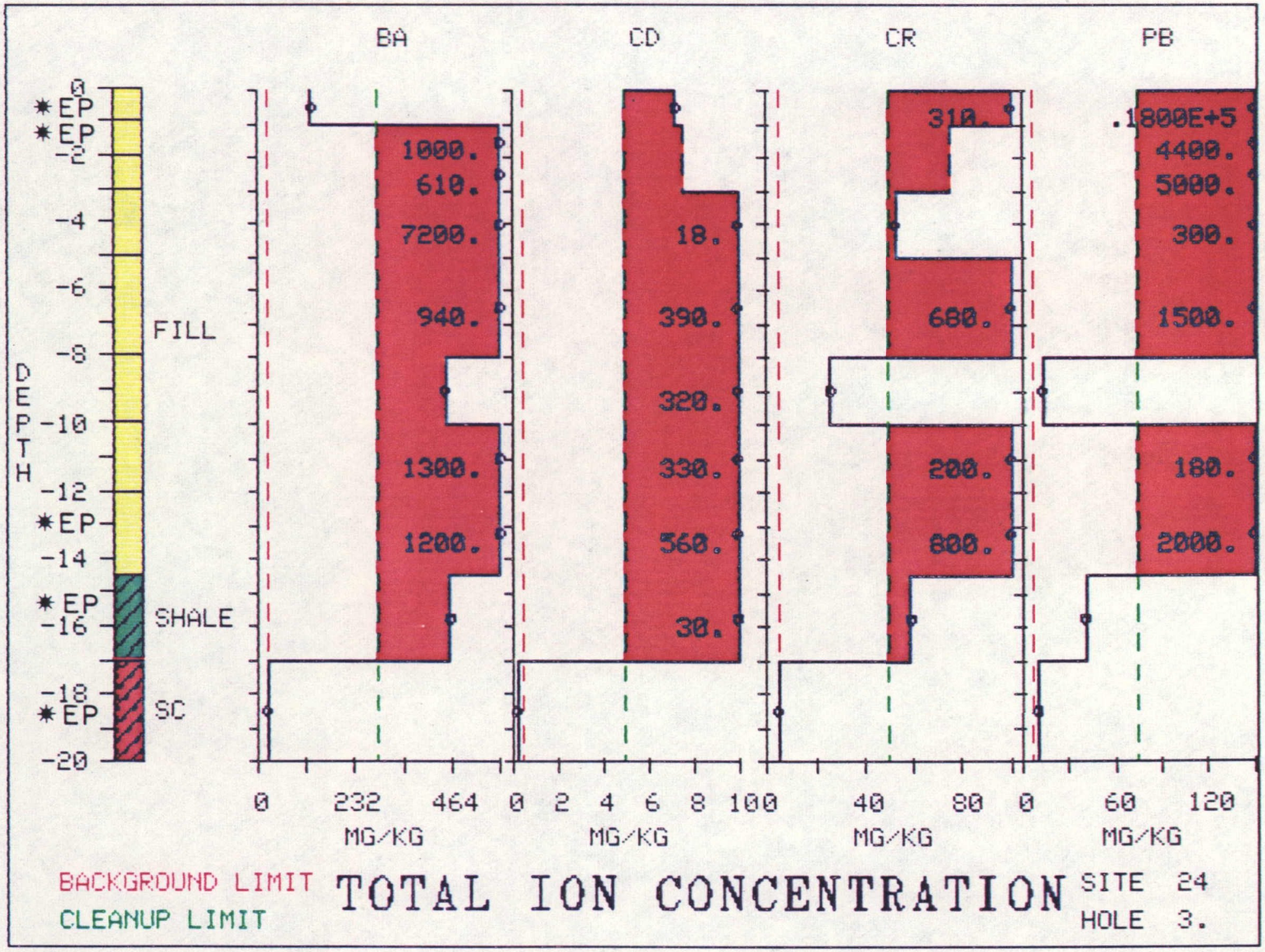
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 2.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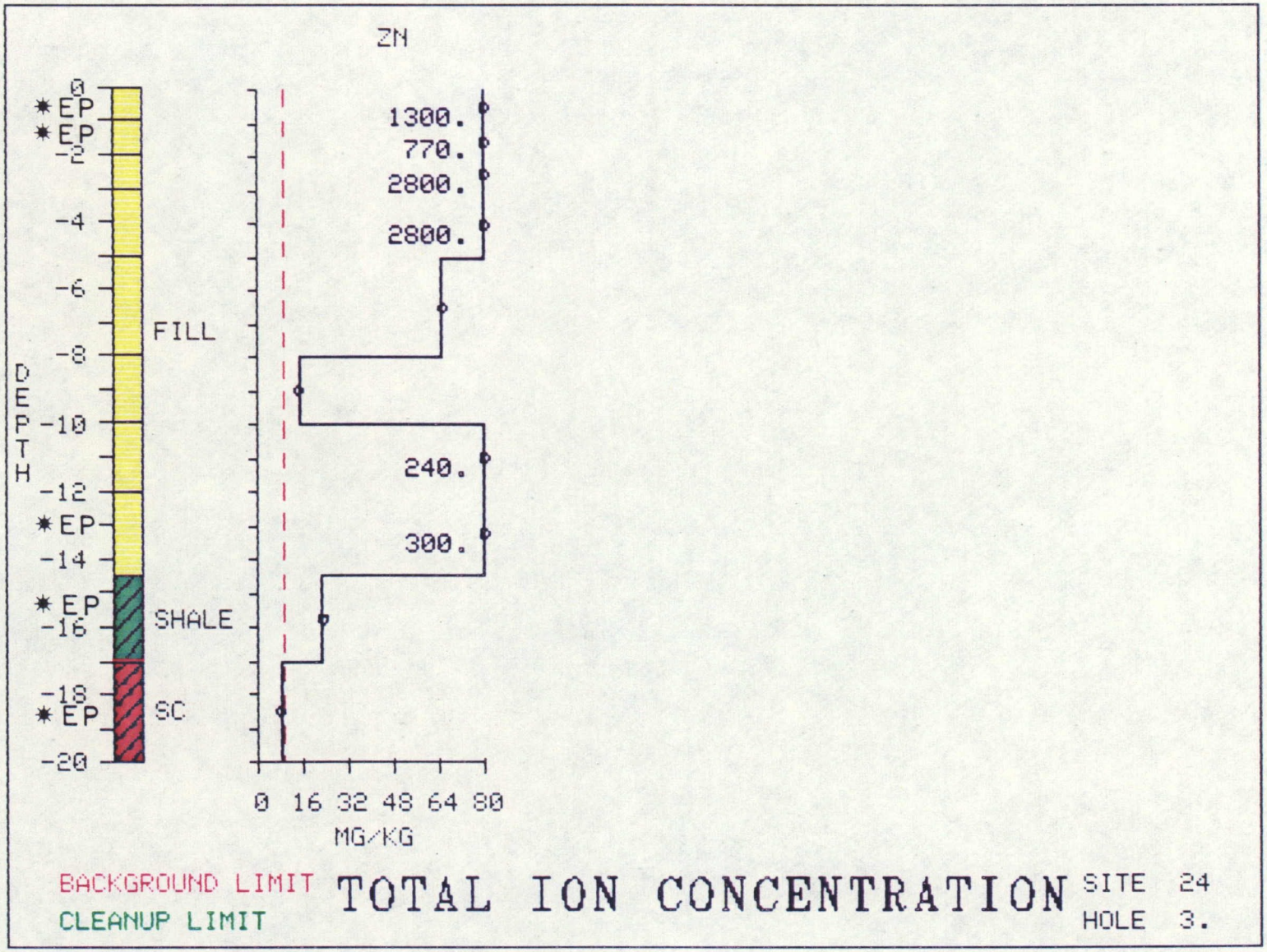
SHALE
SC
1000.
610.
7200.
940.
1300.
1200.
18.
390.
320.
330.
560.
30.
310.
680.
200.
800.
.1800E+5
4400.
5000.
300.
1500.
180.
2000.
0
232
464
0
2
4
6
8
100
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 3.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-20
FILL
SHALE
SC
1300.
770.
2800.
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240.
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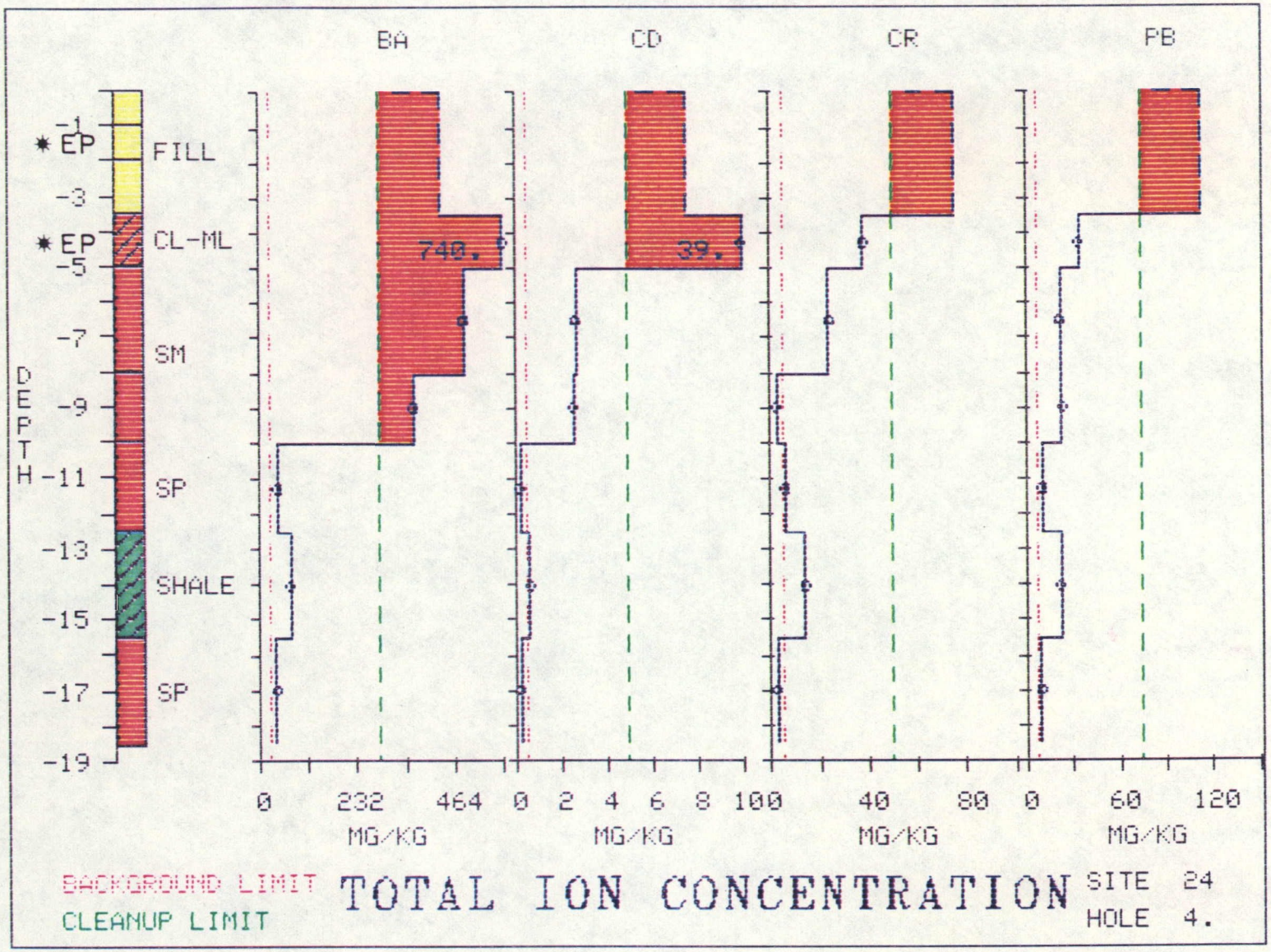
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 3.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SP
SHALE
SP
740.
39.
0
232
464
0
2
4
6
8
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40
80
0
60
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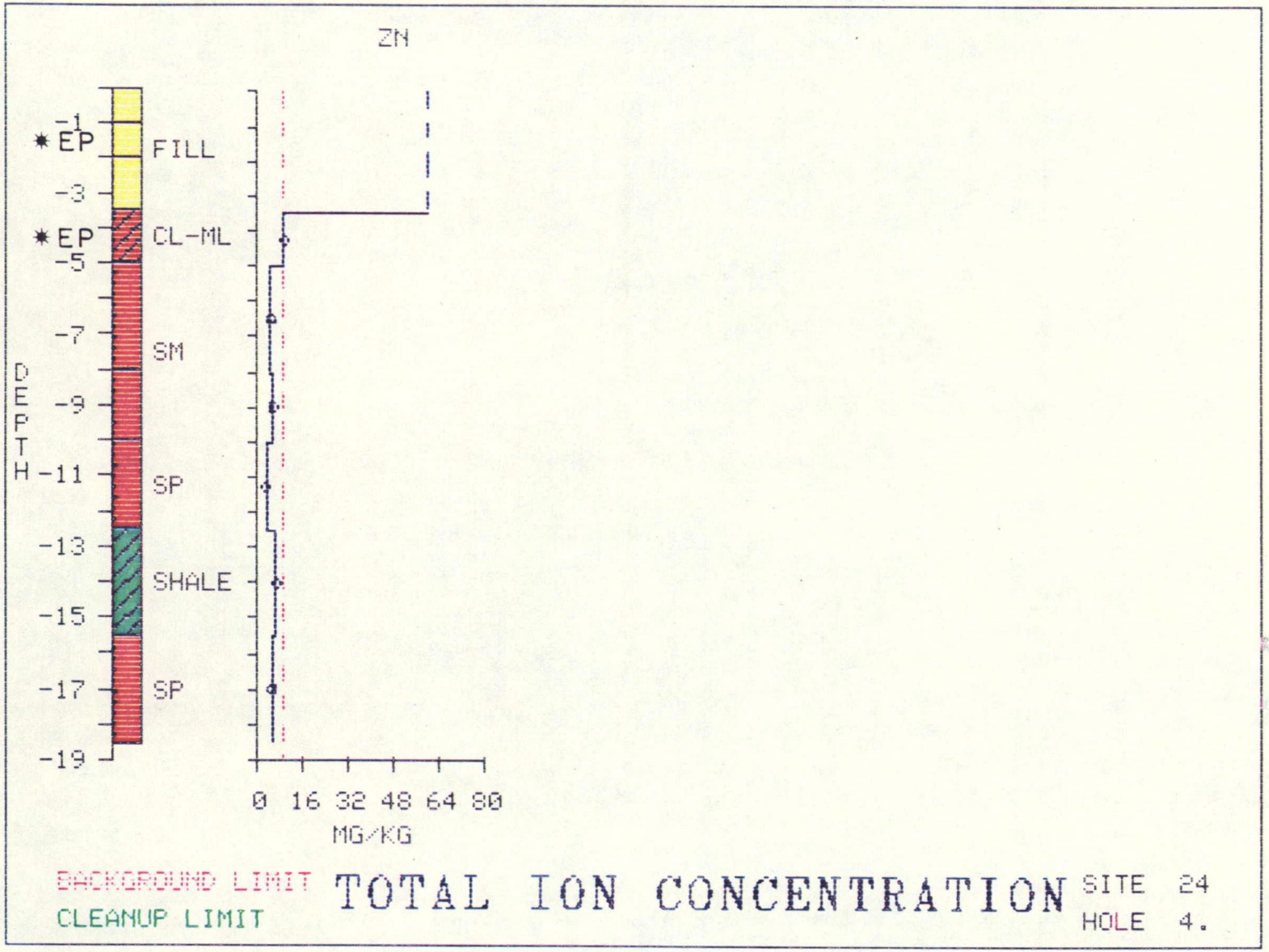
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 4.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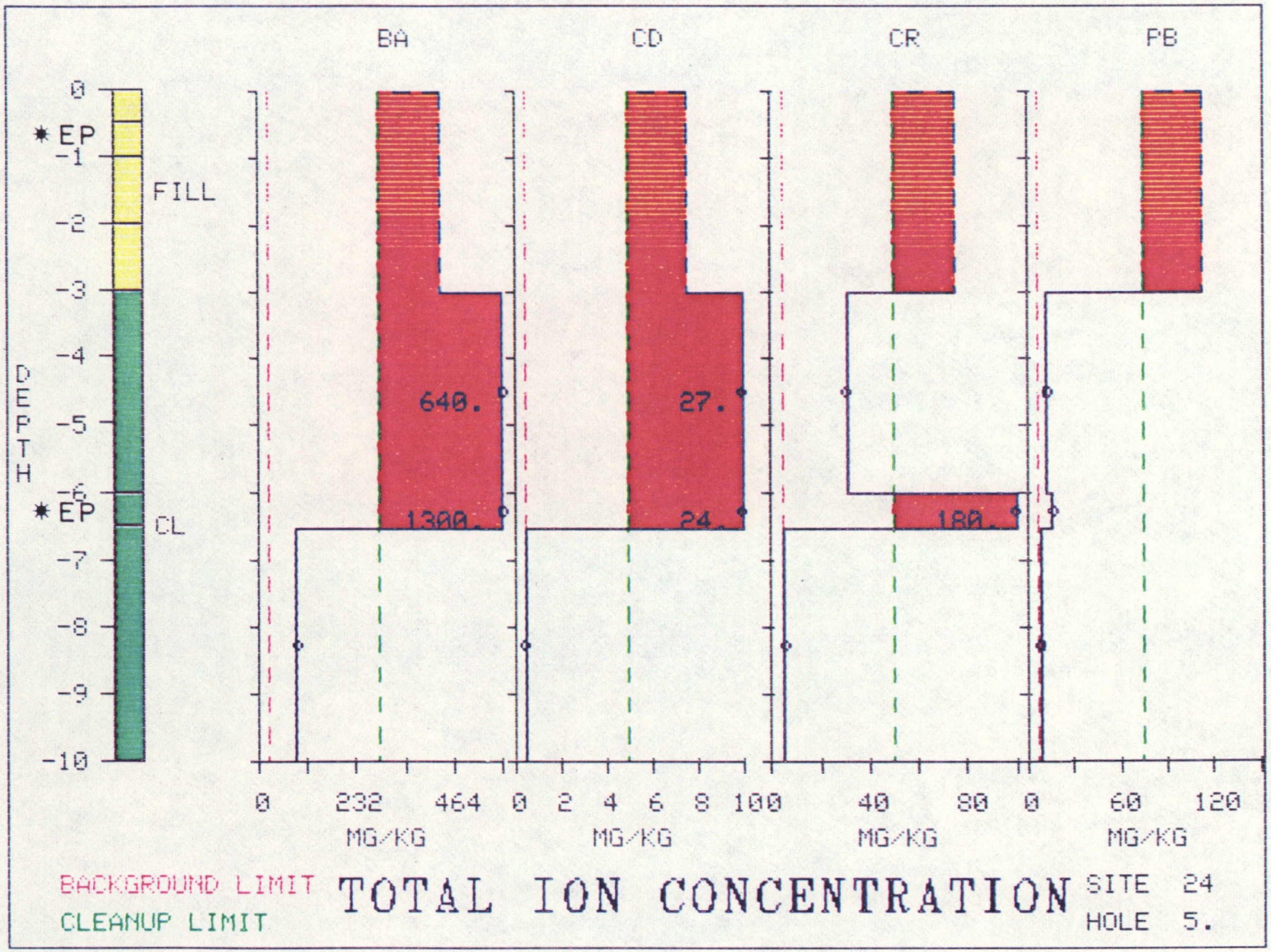
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 4.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-10
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180.
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232
464
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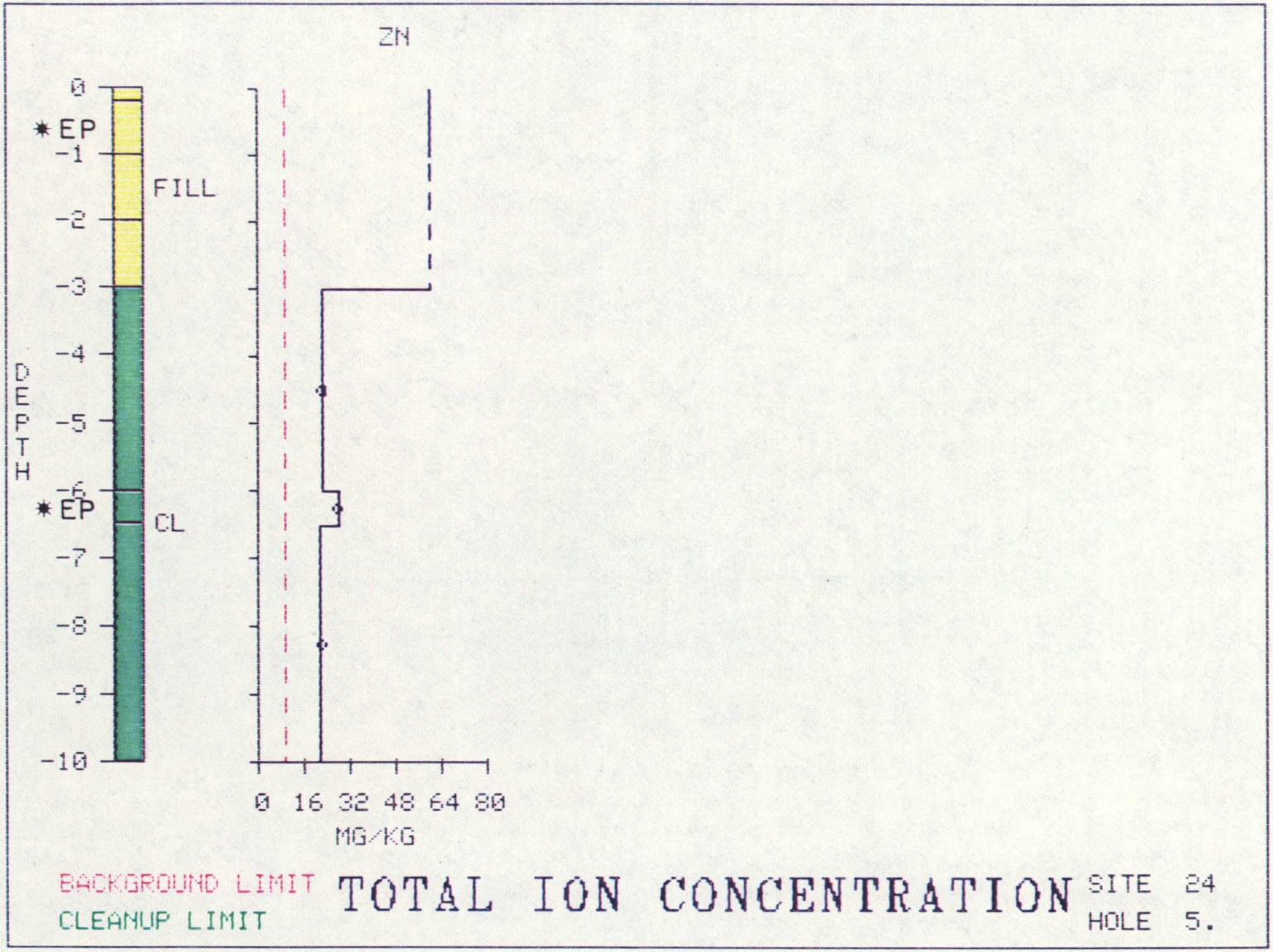
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 5.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MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
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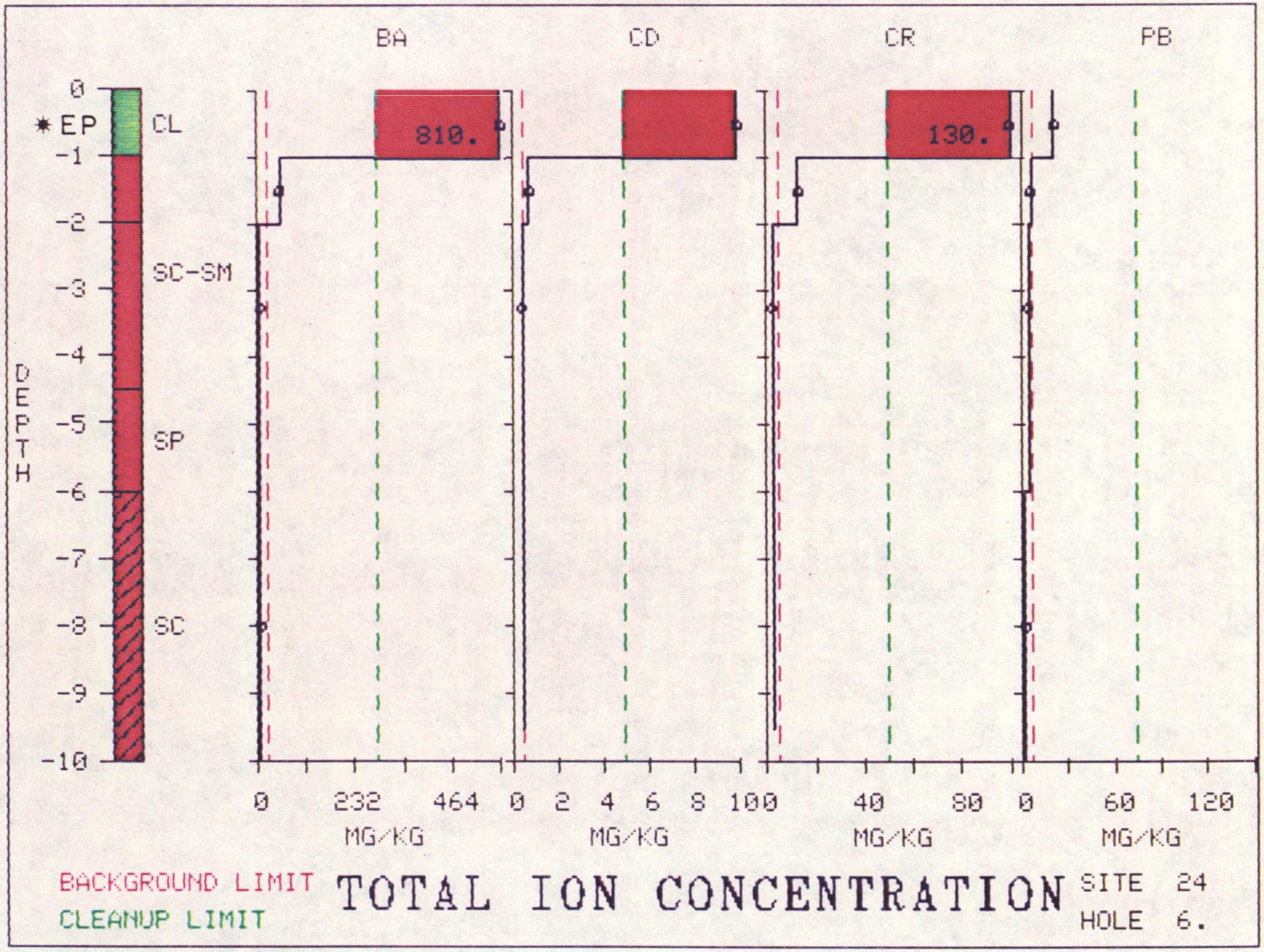
HOLE 5.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DEPTH
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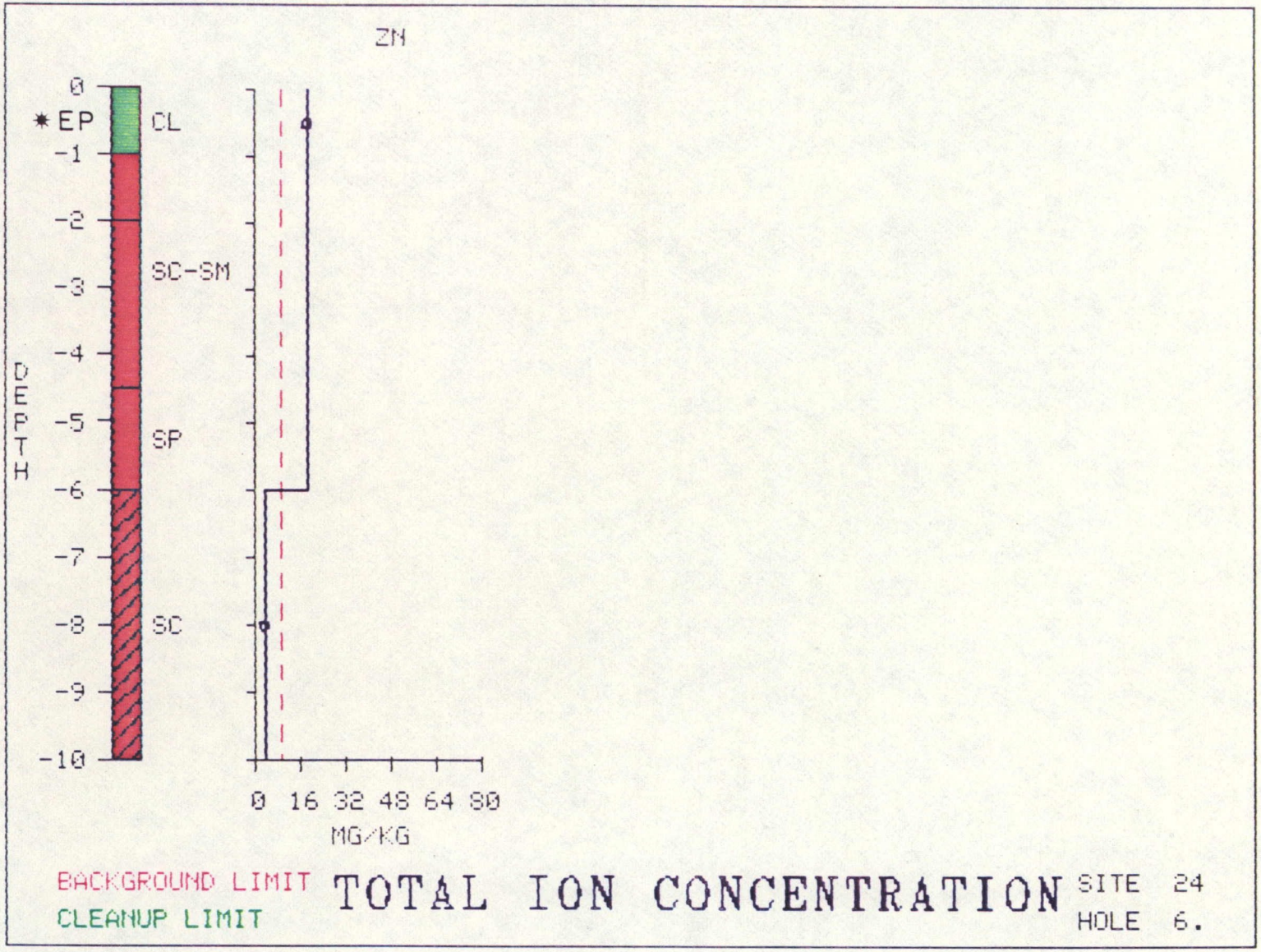
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 6.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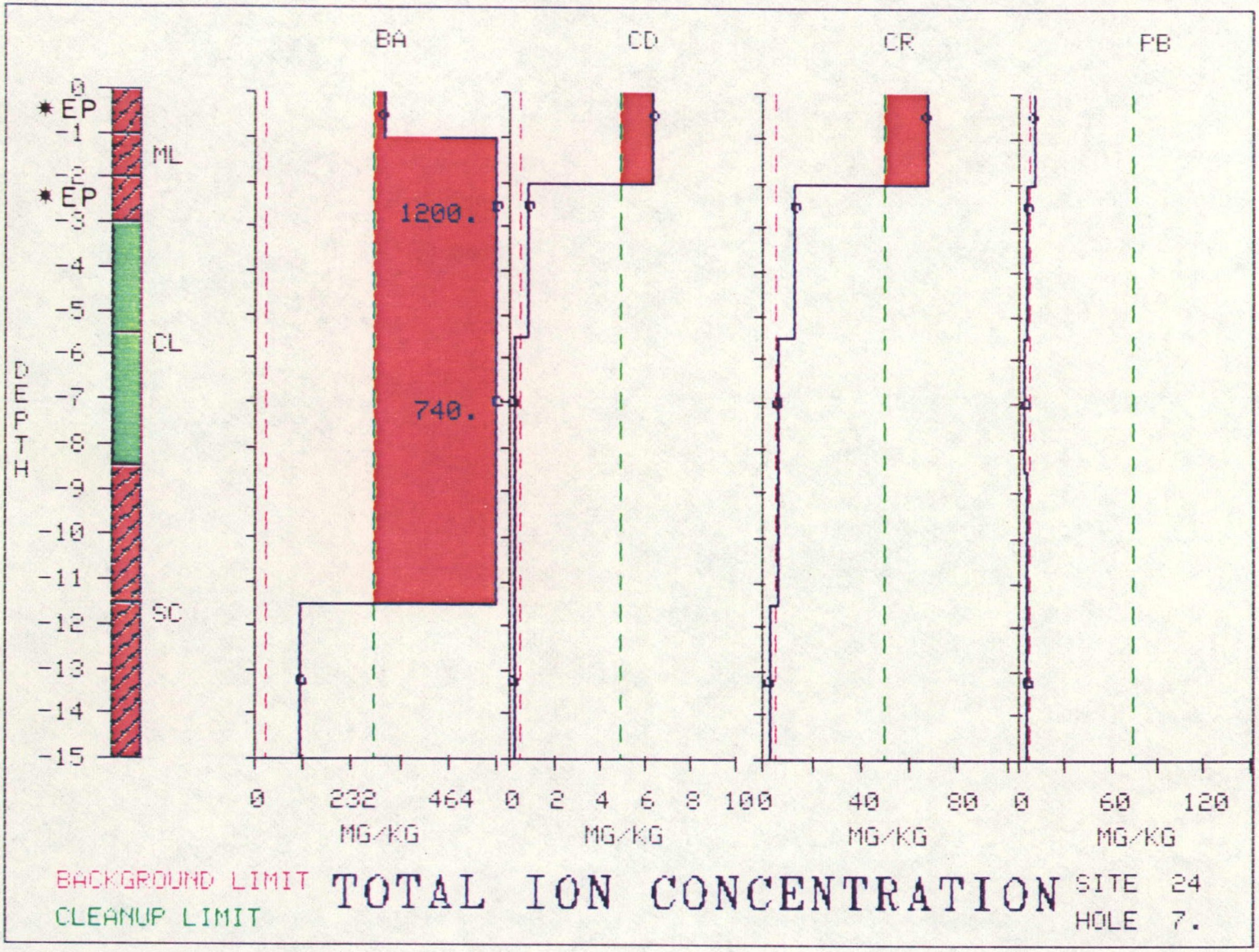
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 6.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MG/KG
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100
MG/KG
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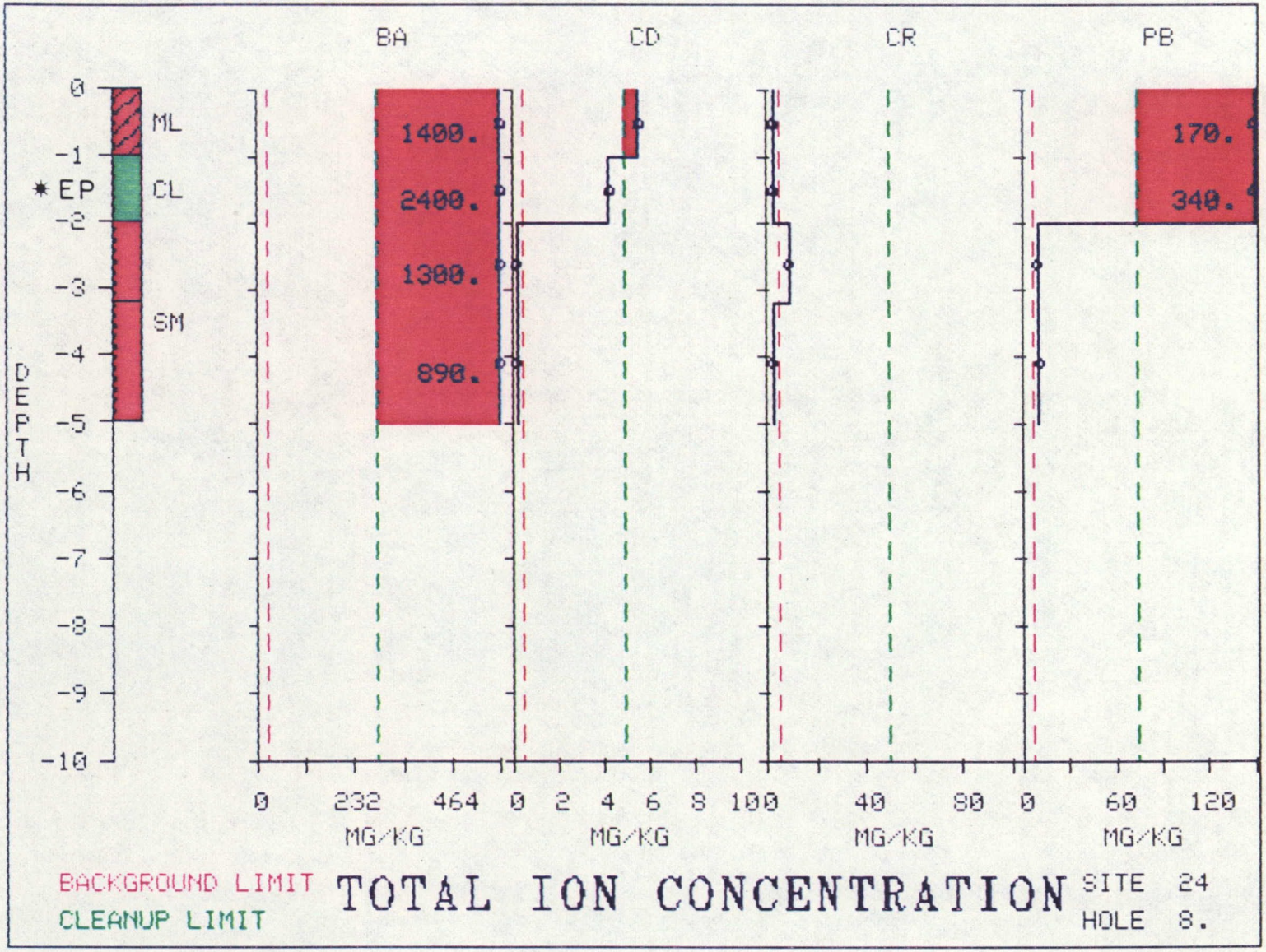
120
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 7.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CL
SM
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2400.
1300.
890.
170.
340.
0
232
464
0
2
4
6
8
100
40
80
0
60
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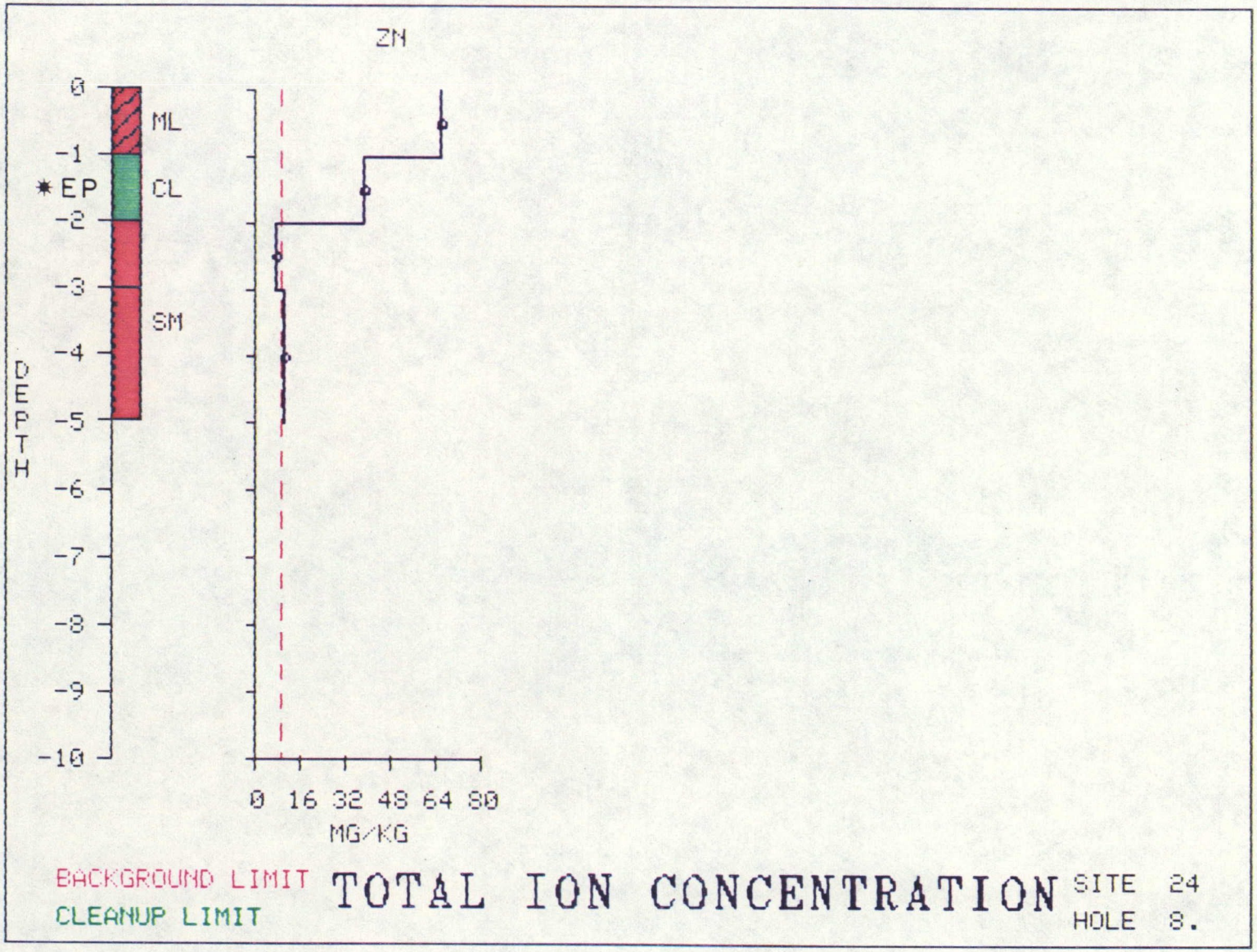
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 8.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DEPTH
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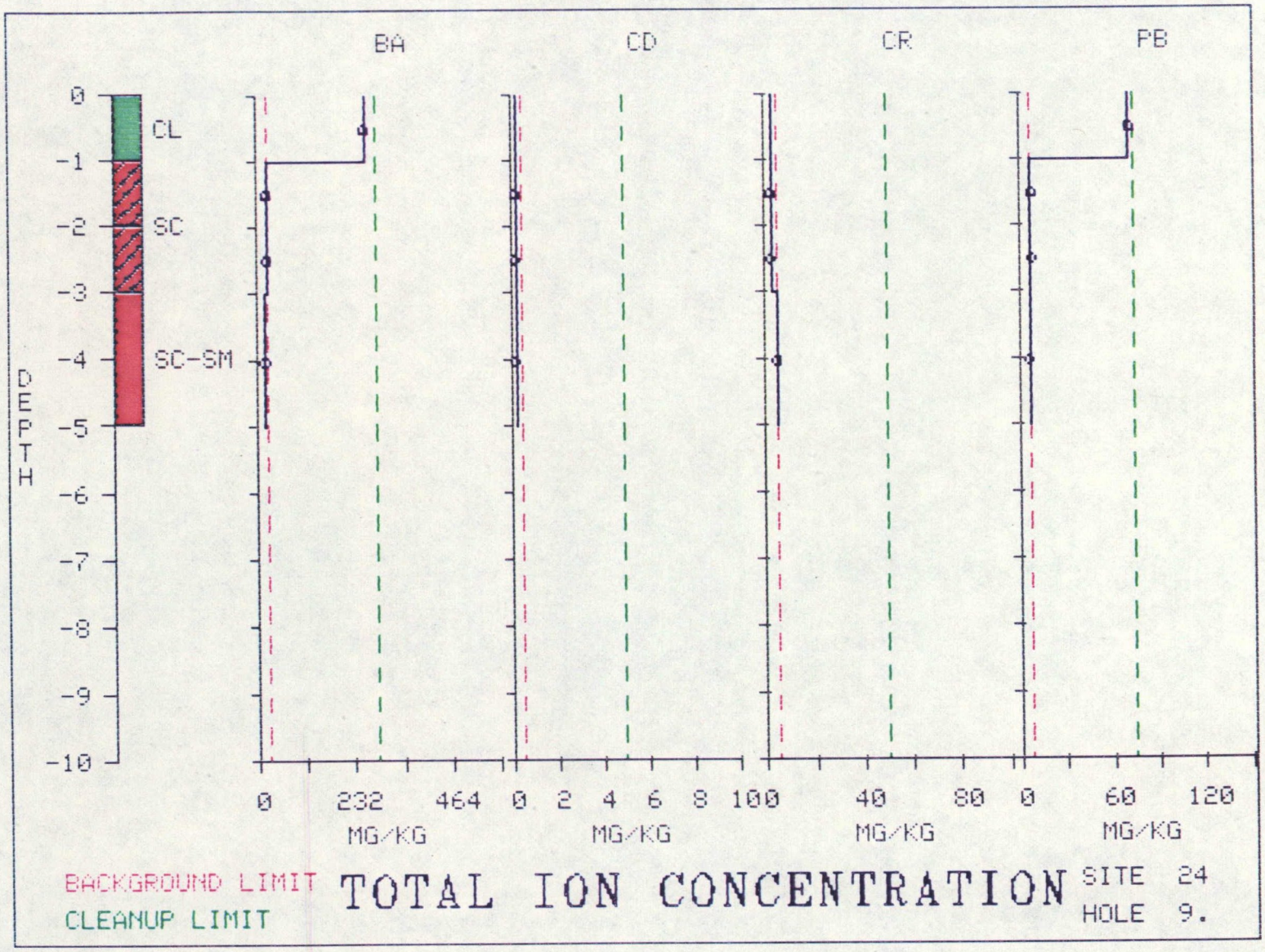
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 8.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-10
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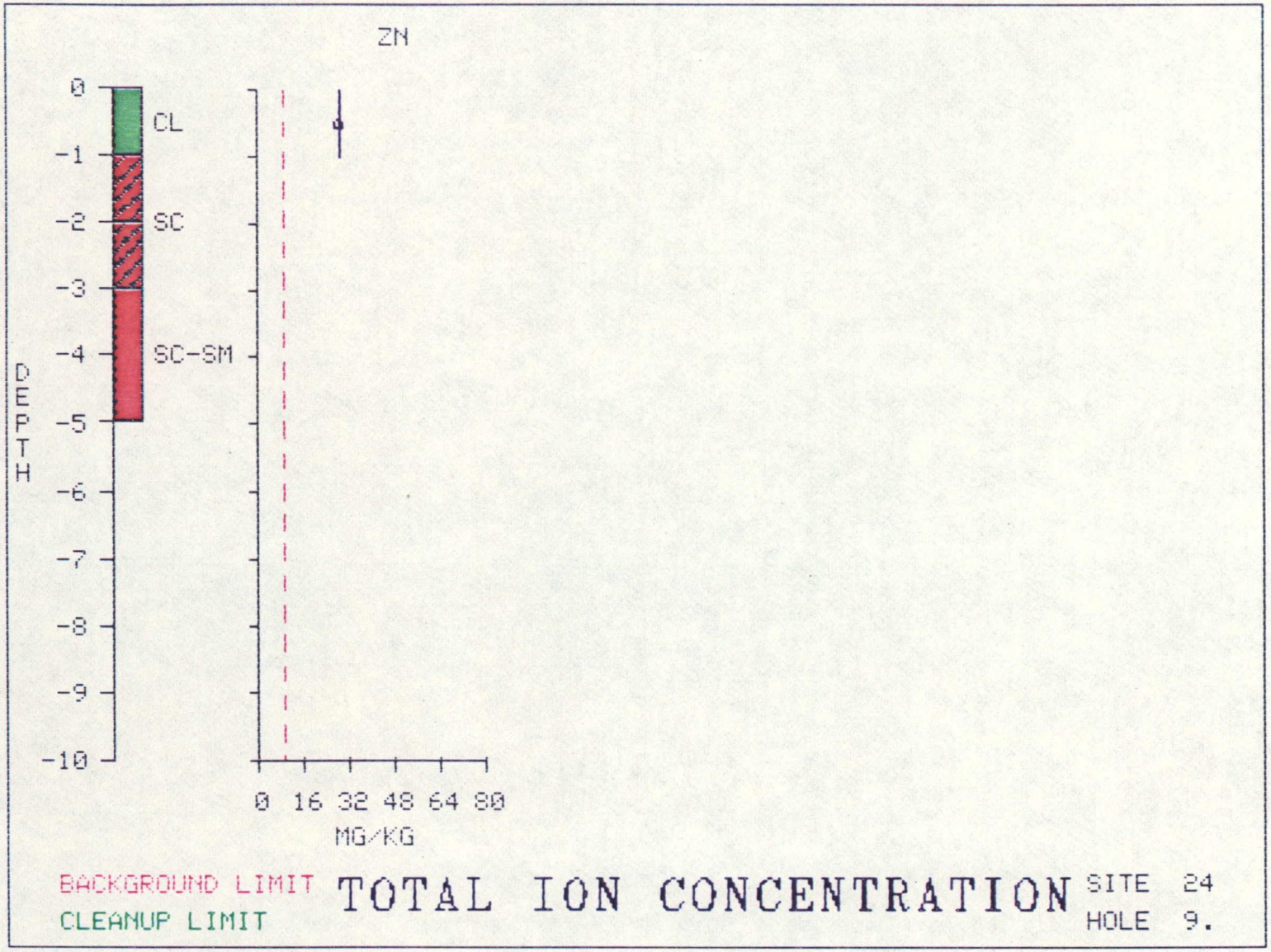
464
0
2
4
6
8
100
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 9.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DEPTH
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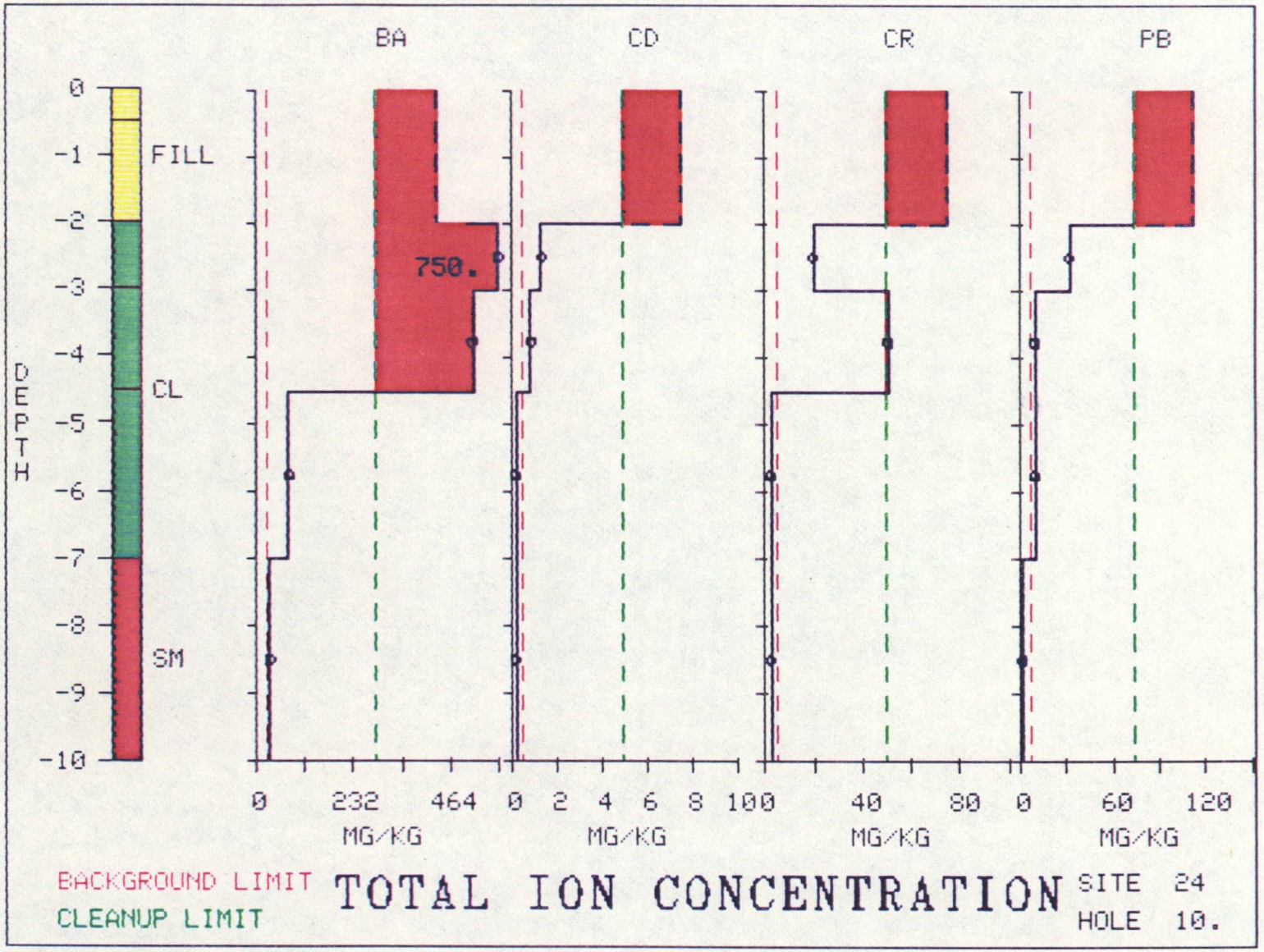
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 9.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DEPTH
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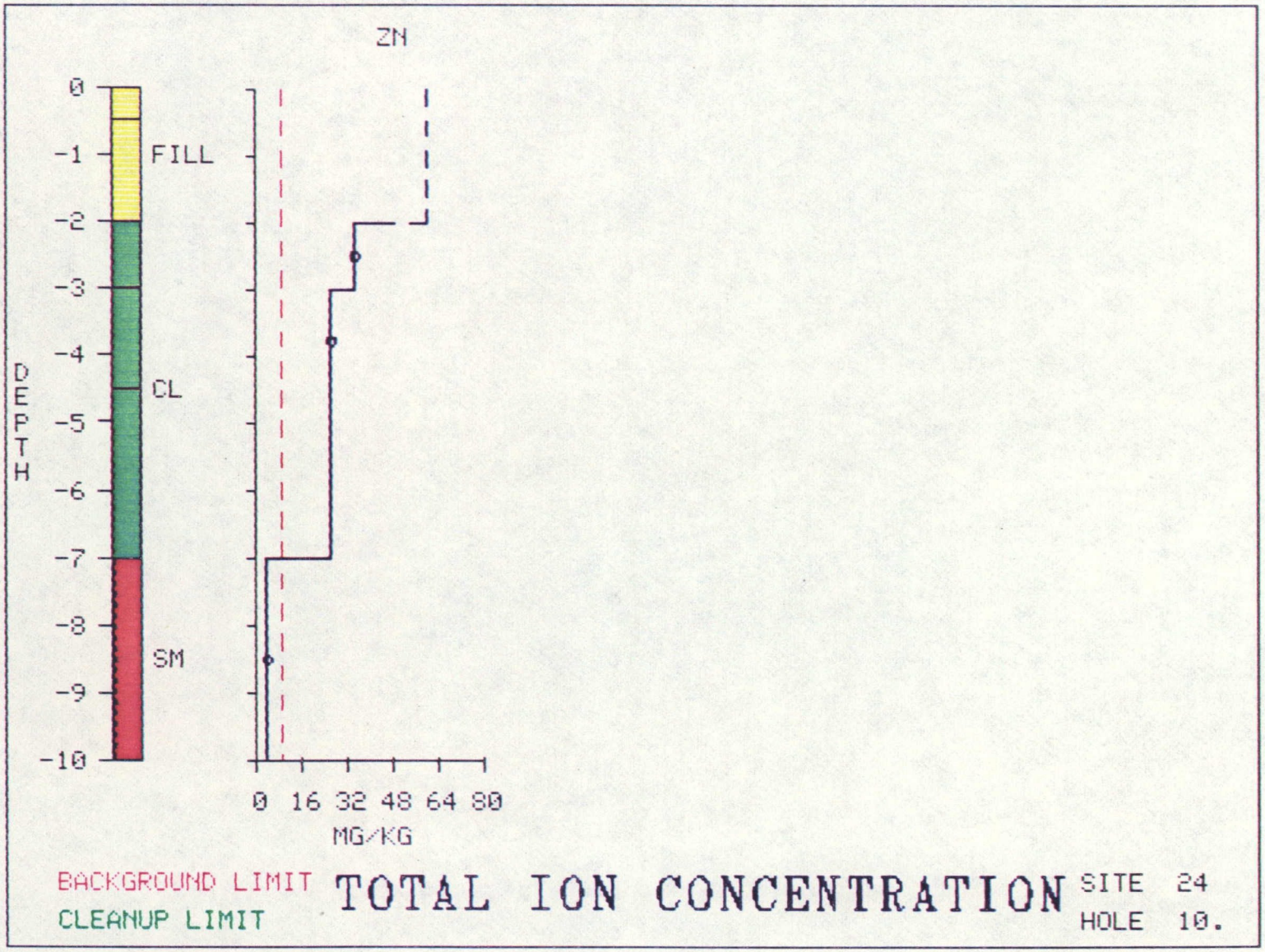
464
0
2
4
6
8
100
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 10.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DEPTH
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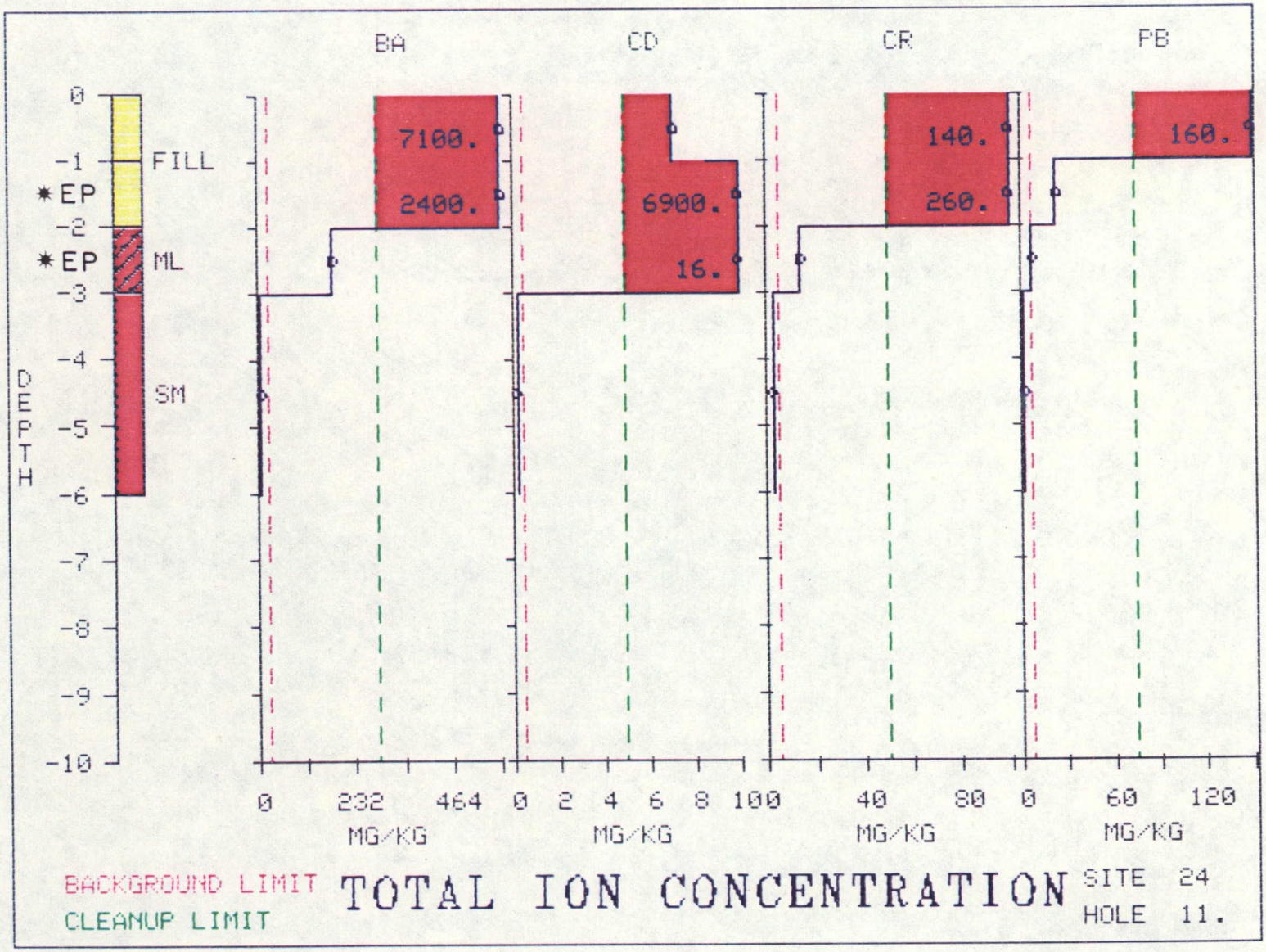
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 10.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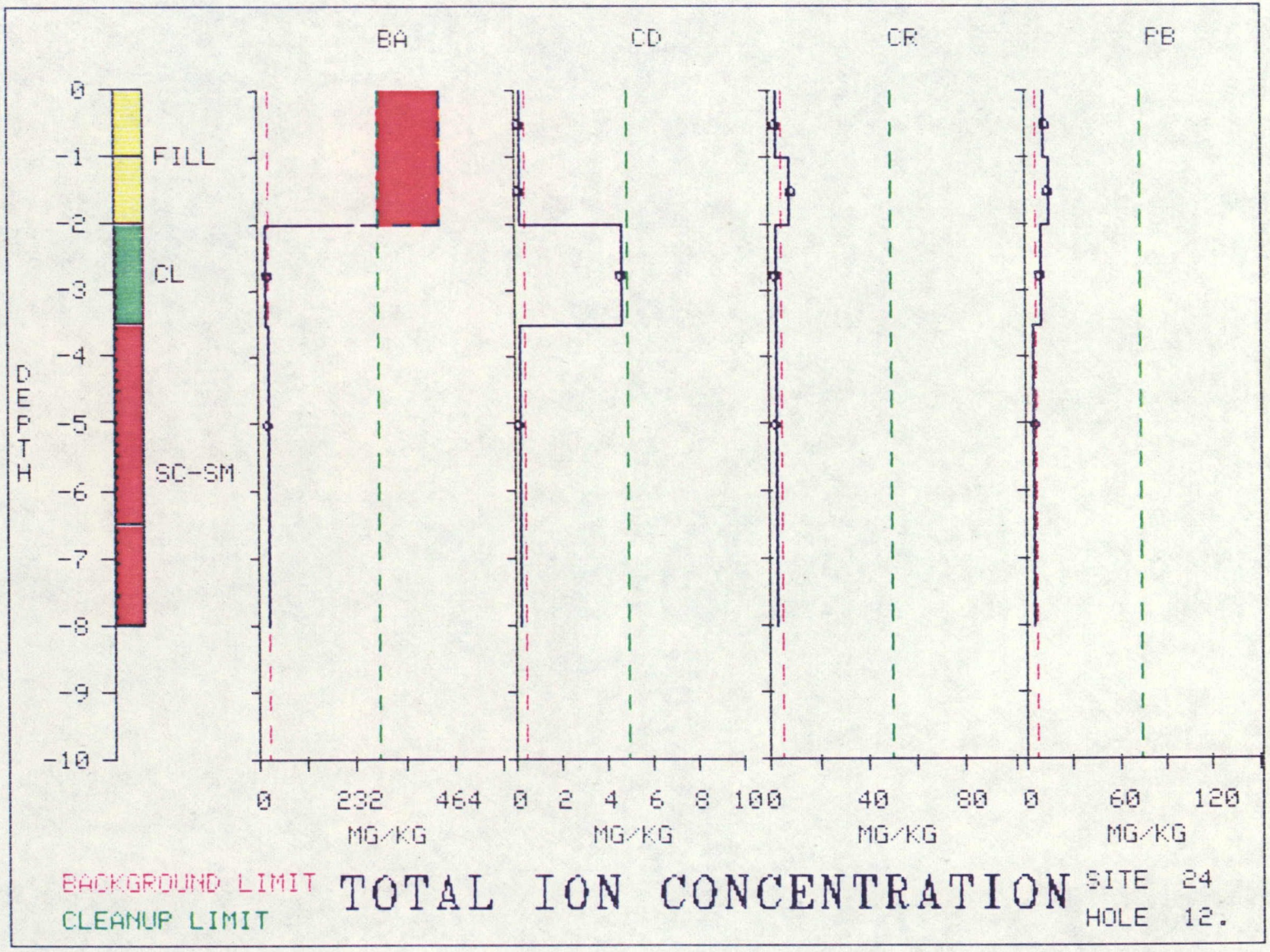
EP
ML
EP
SM
7100.
2400.
6900.
16.
140.
260.
160.
0
232
464
0
2
4
6
8
100
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 11.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DEPTH
FILL
CL
SC-SM
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232
464
0
2
4
6
8
100
40
80
0
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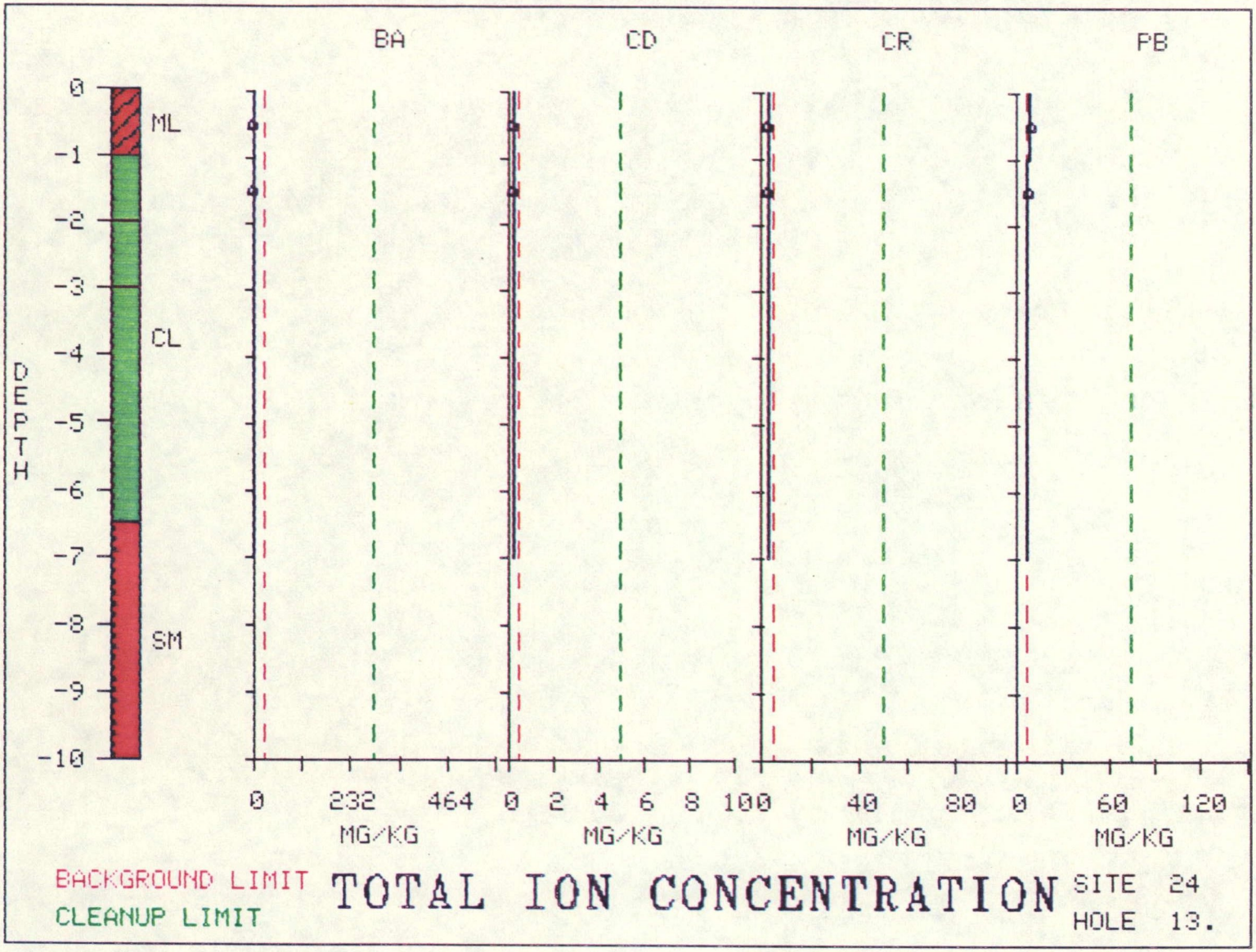
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 12.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CR
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DEPTH
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-1
-2
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-4
-5
-6
-7
-8
-9
-10
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CL
SM
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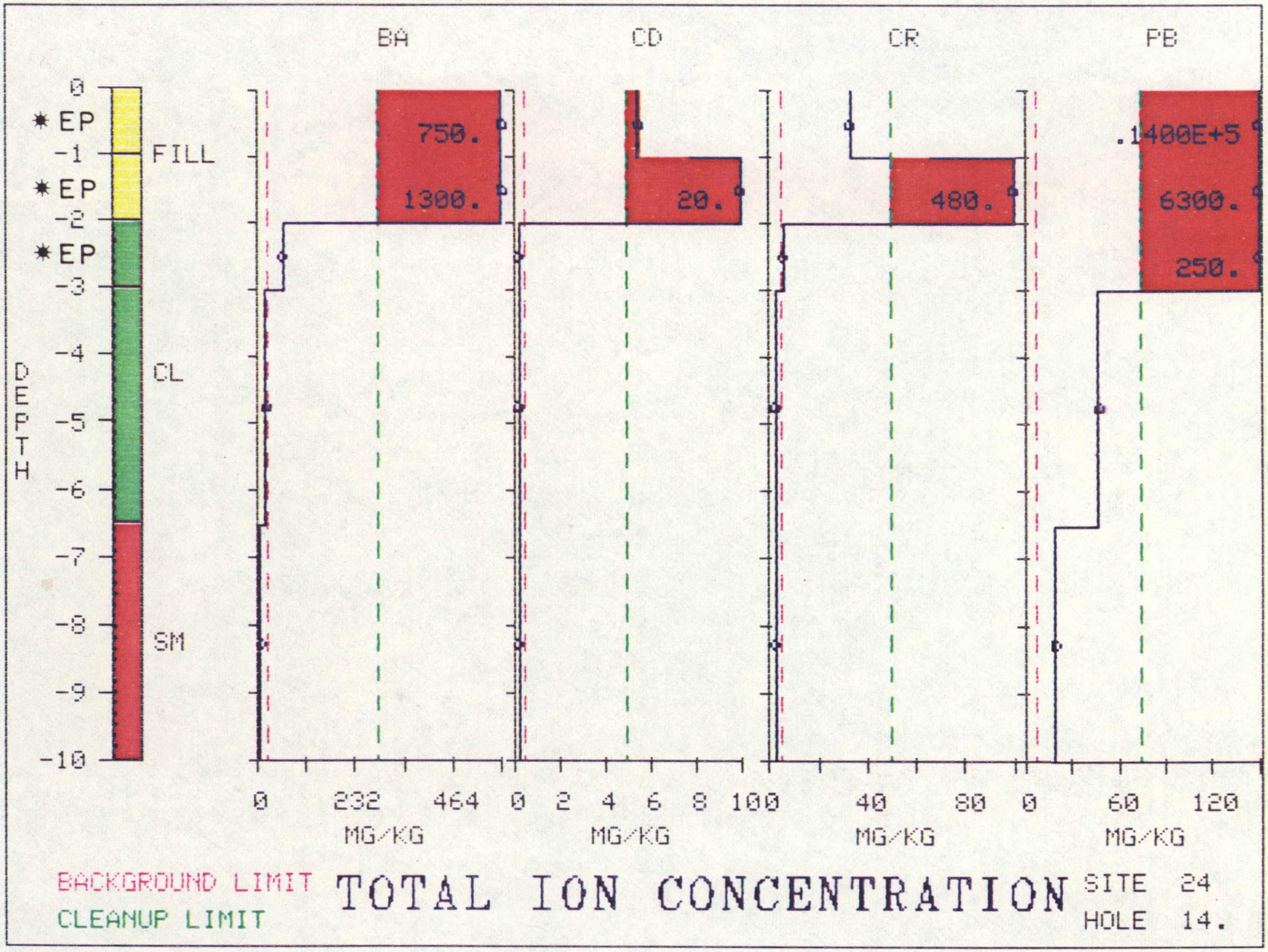
232
464
0
2
4
6
8
100
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 13.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CR
PB
DEPTH
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-2
-3
-4
-5
-6
-7
-8
-9
-10
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FILL
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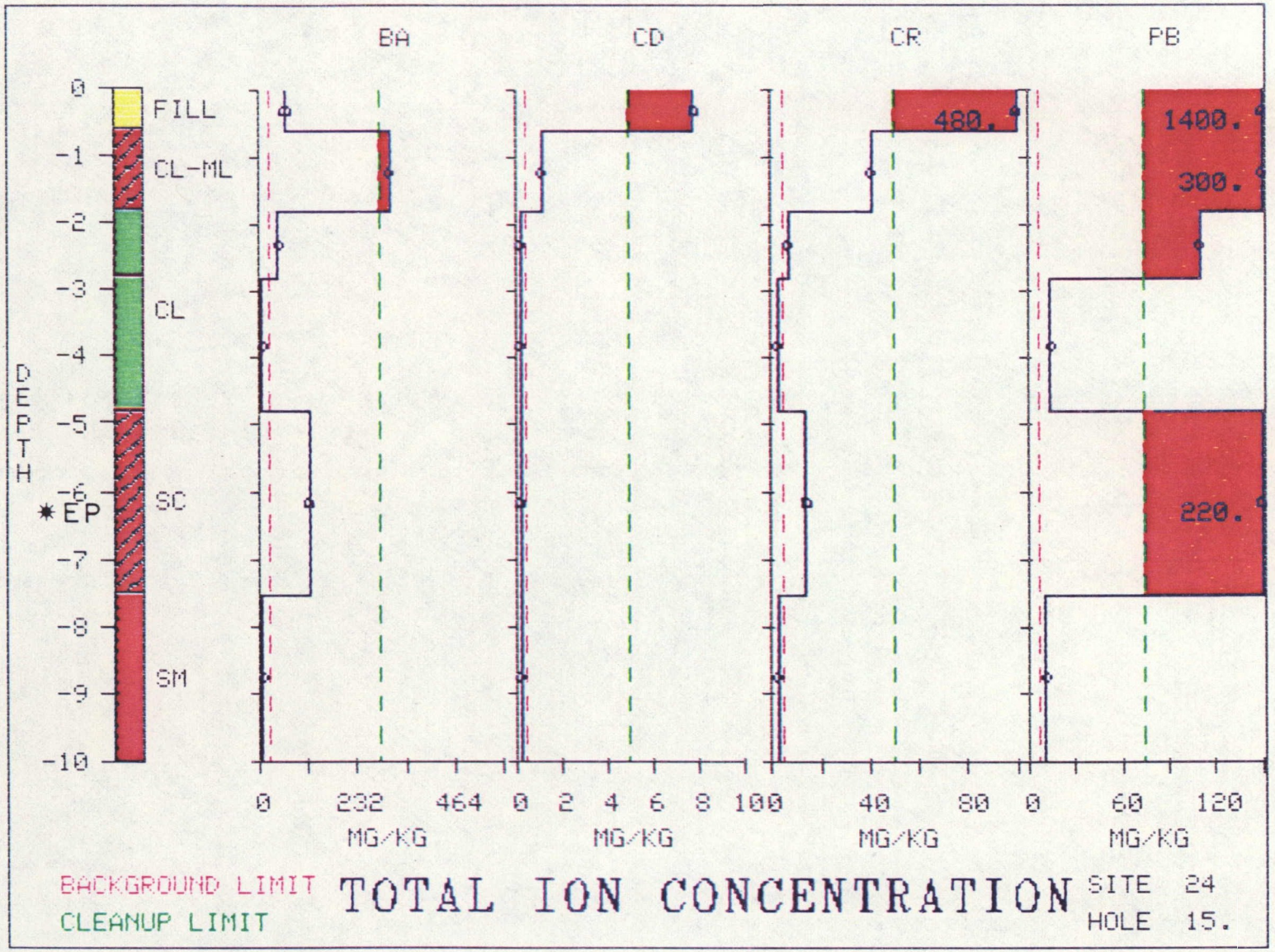
1300.
20.
480.
.1400E+5
6300.
250.
0
232
464
0
2
4
6
8
100
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 14.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CD
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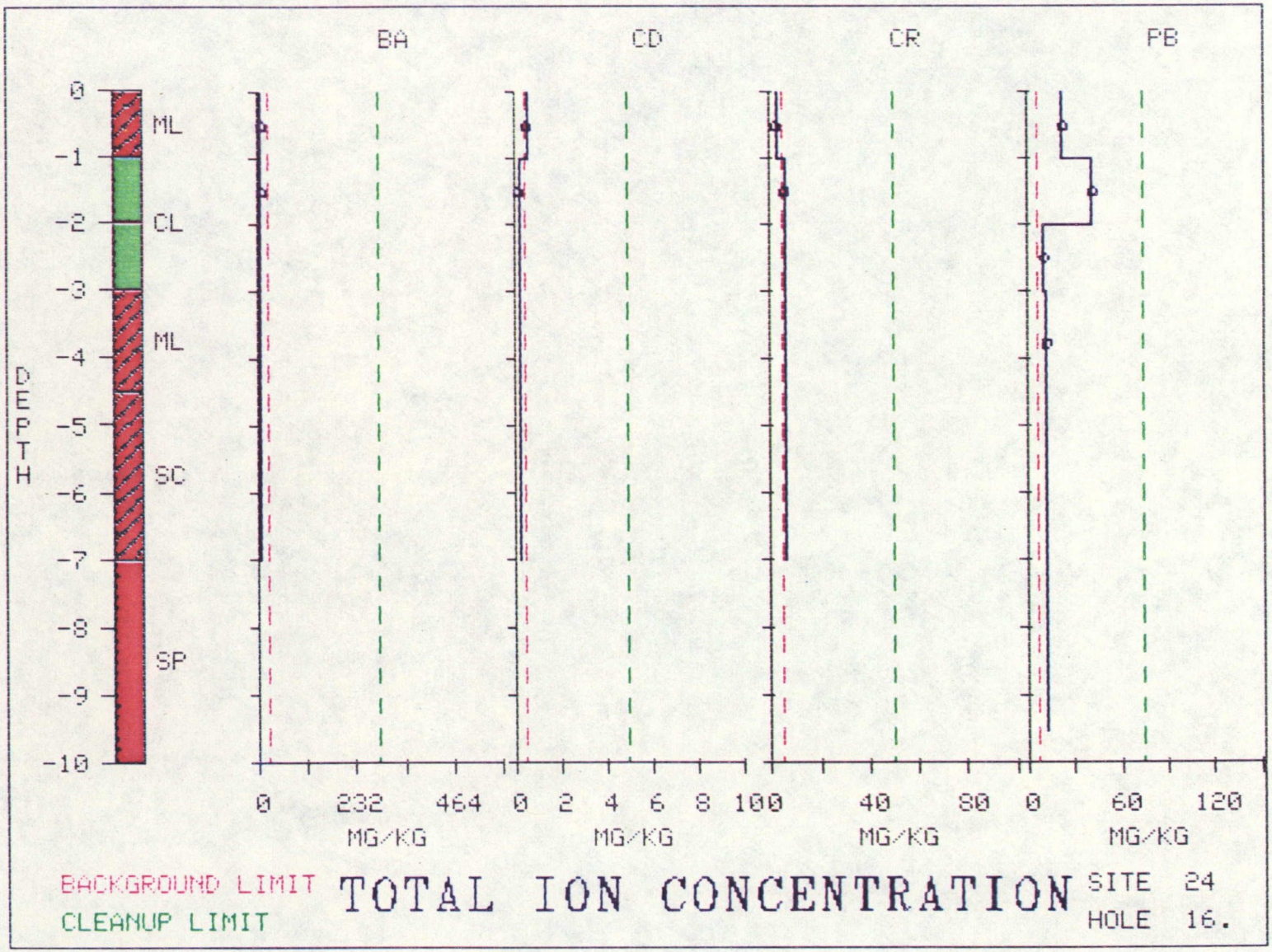
PB
DEPTH
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
EP
FILL
CL-ML
CL
SC
SM
480.
1400.
300.
220.
0
232
464
0
2
4
6
8
100
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 15.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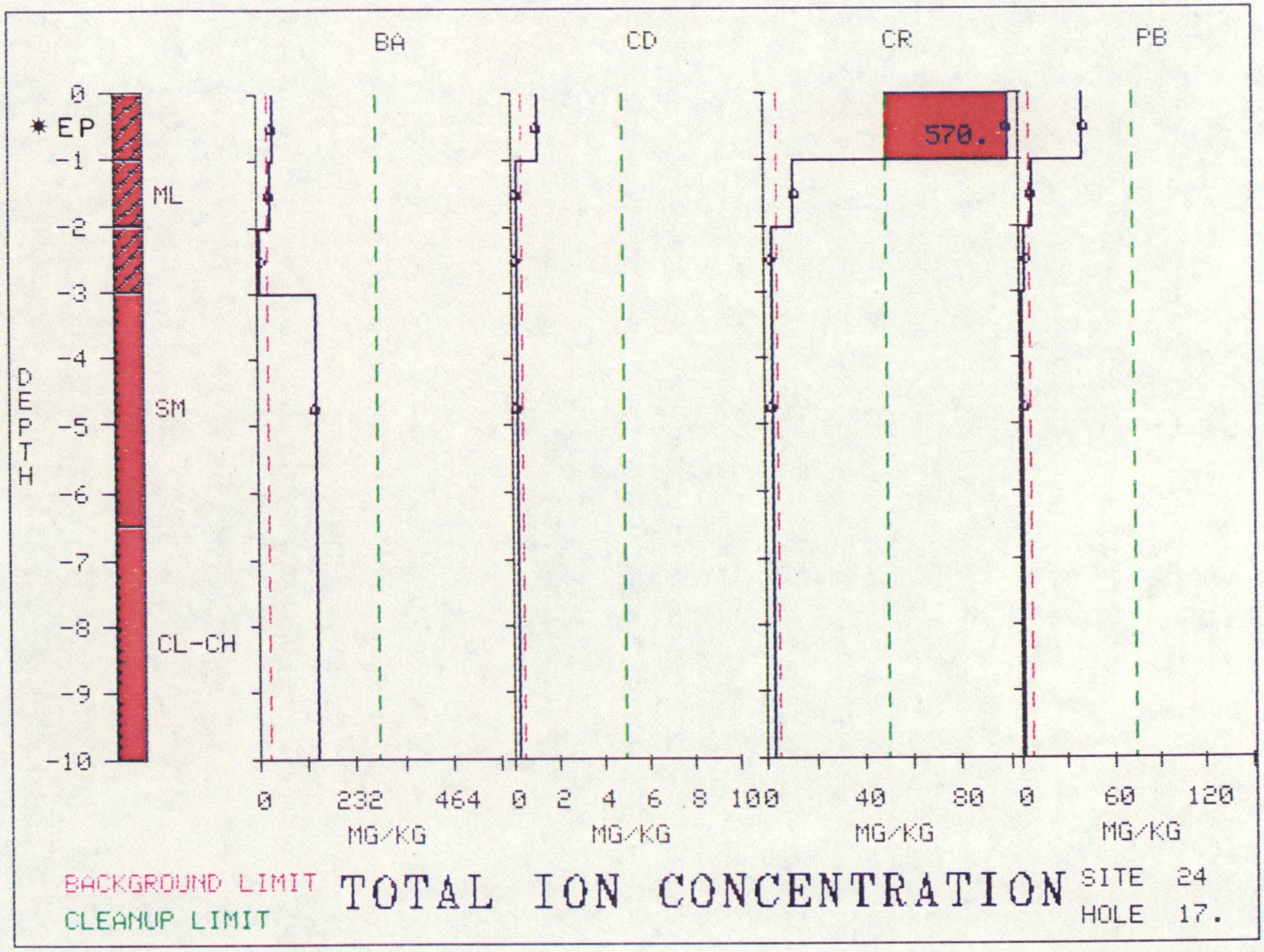
CR
PB
DEPTH
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
ML
CL
ML
SC
SP
0
232
464
0
2
4
6
8
100
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 16.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DEPTH
ML
SM
CL-CH
570.
0
232
464
0
2
4
6
8
100
40
80
0
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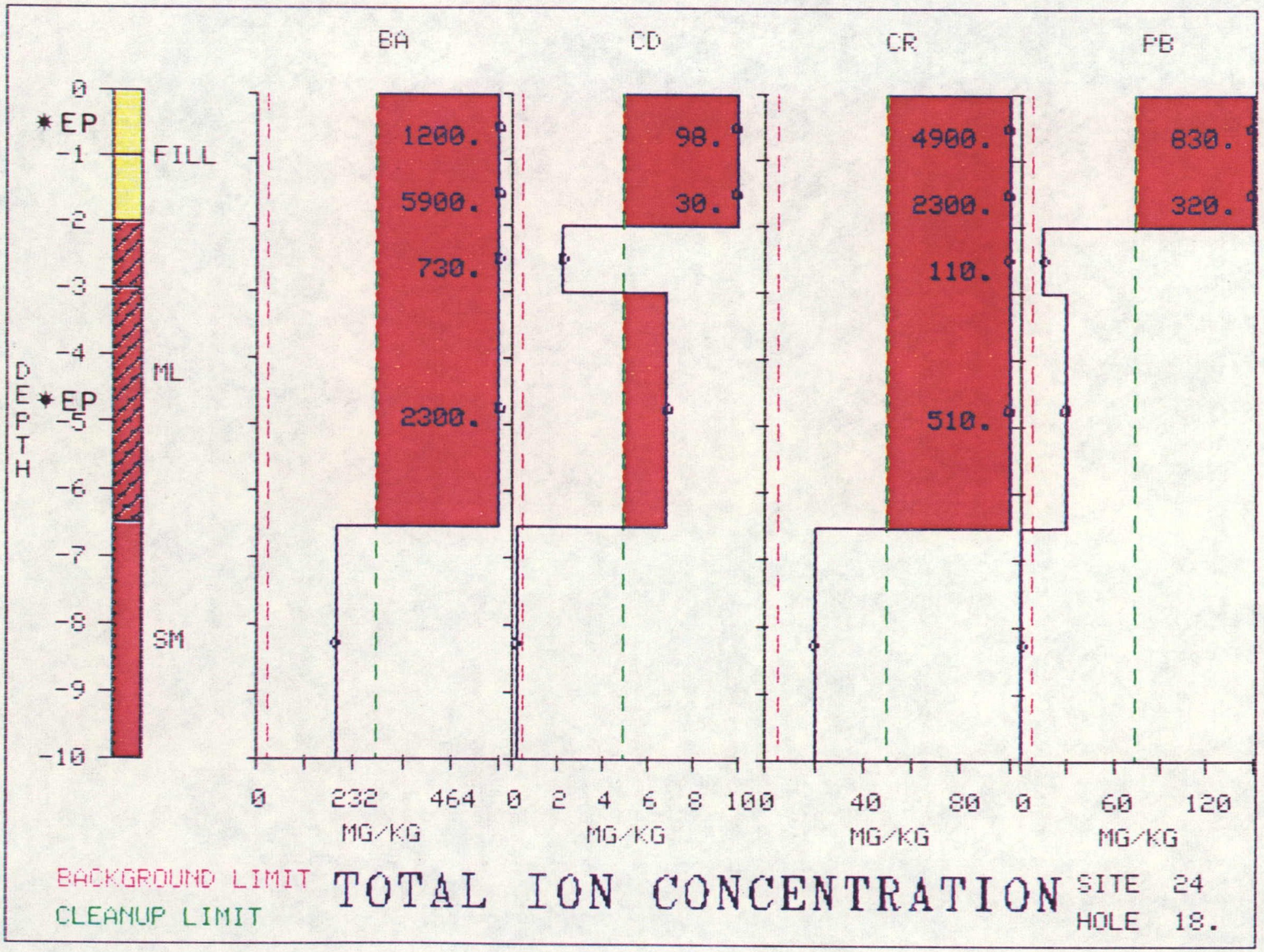
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 17.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SM
1200.
5900.
730.
2300.
98.
30.
4900.
2300.
110.
510.
830.
320.
0
232
464
0
2
4
6
8
100
40
80
0
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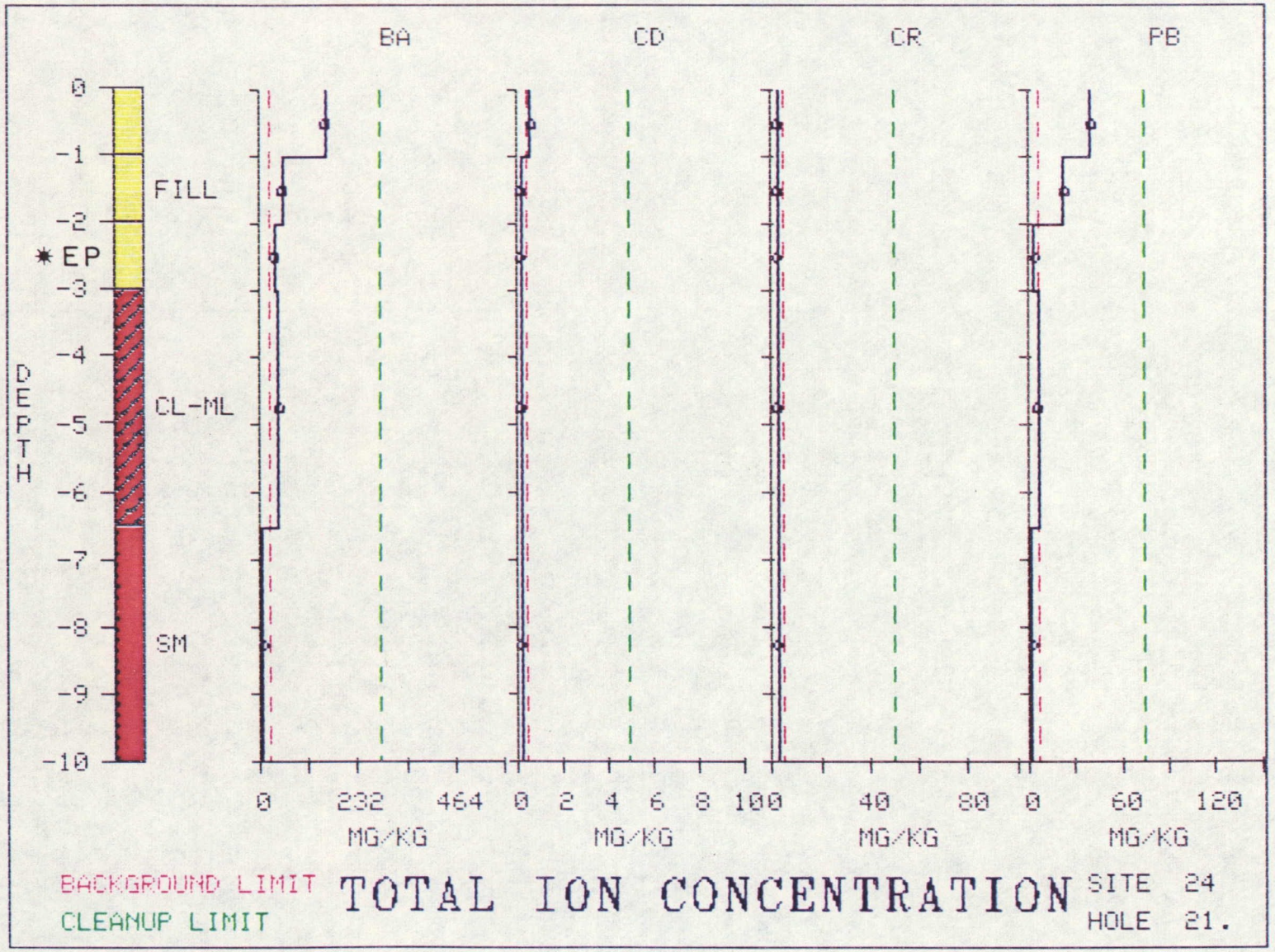
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 18.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464
0
2
4
6
8
100
40
80
0
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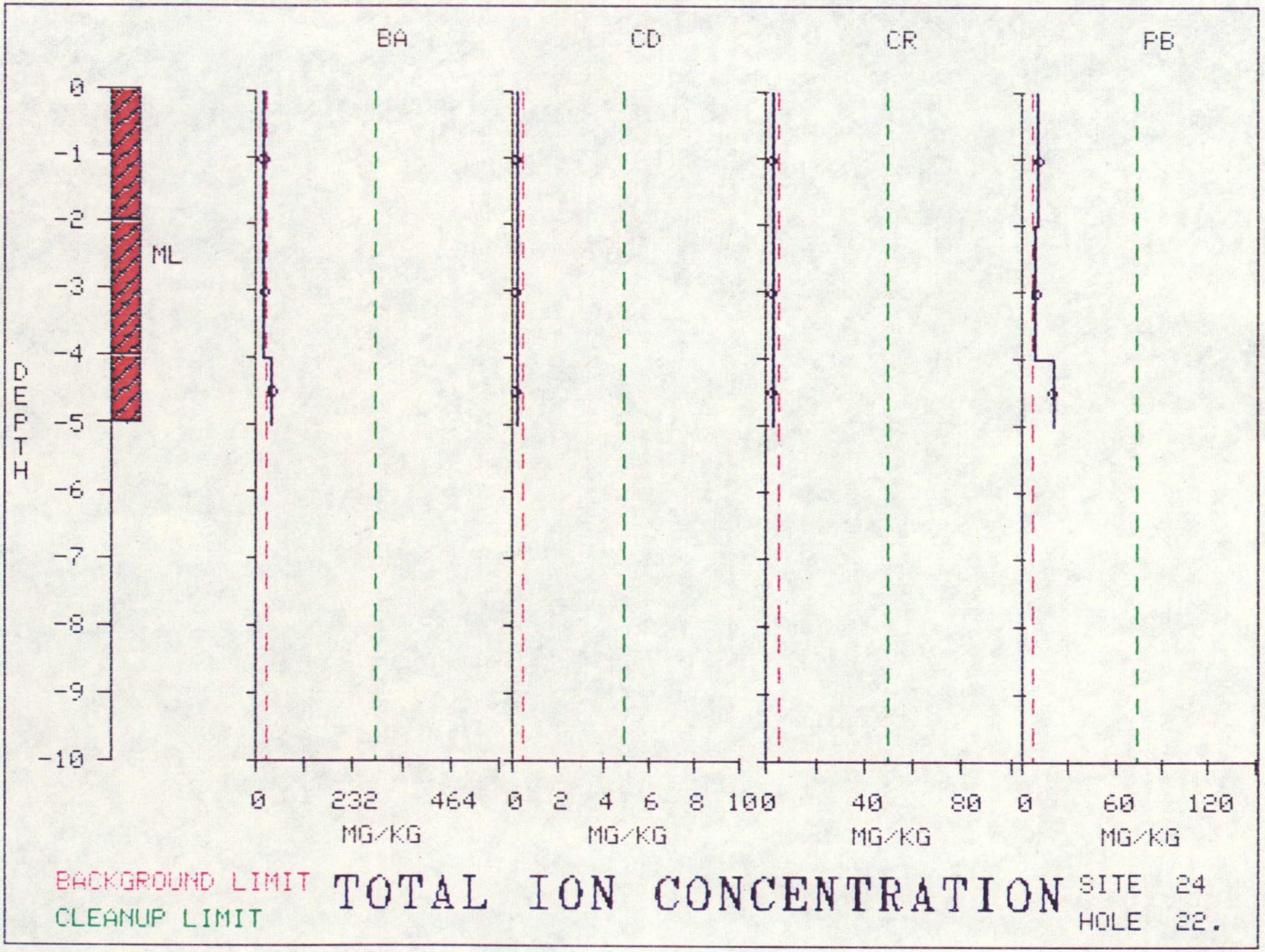
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 21.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464
0
2
4
6
8
100
40
80
0
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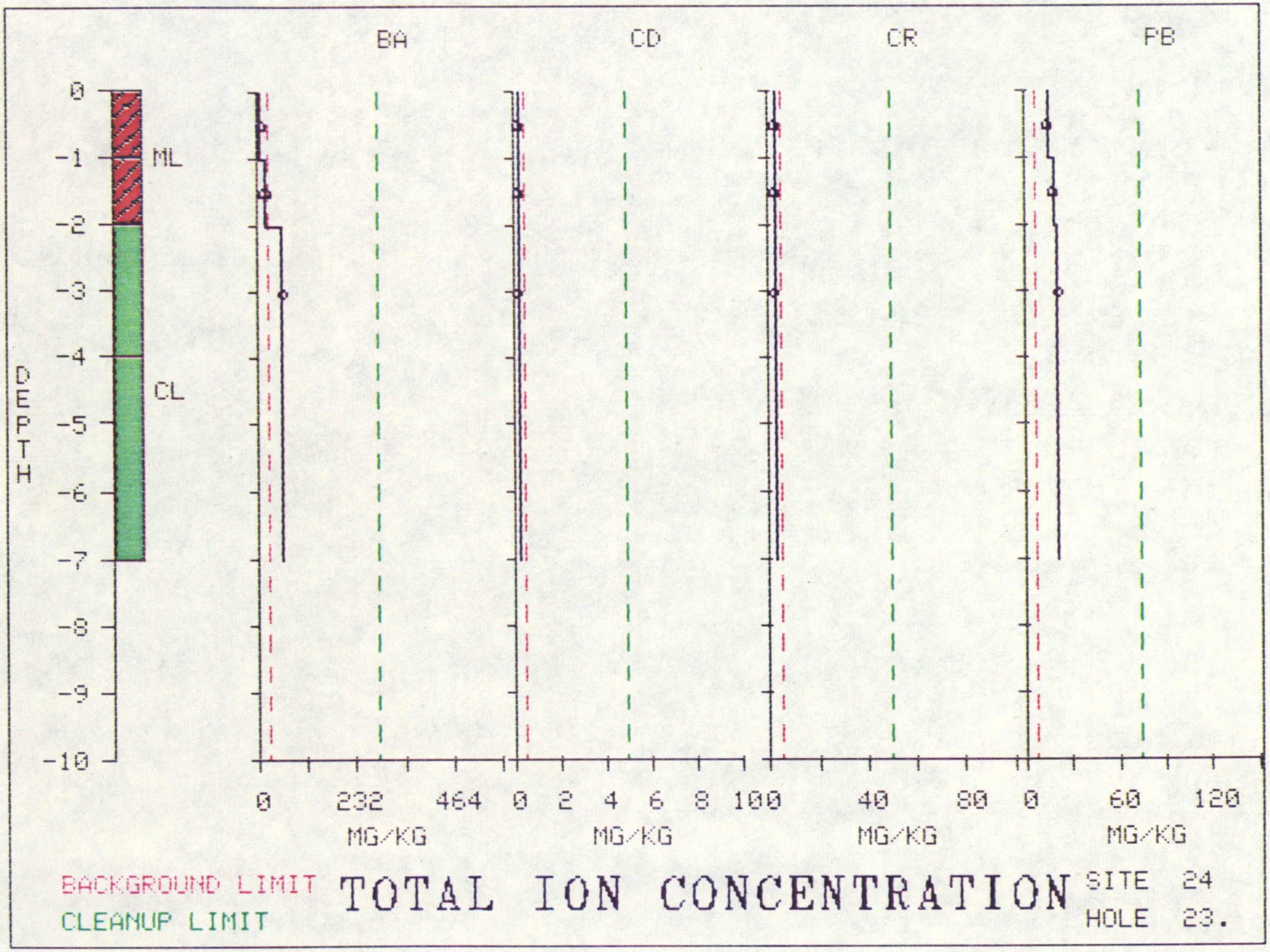
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 22.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464
0
2
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100
40
80
0
60
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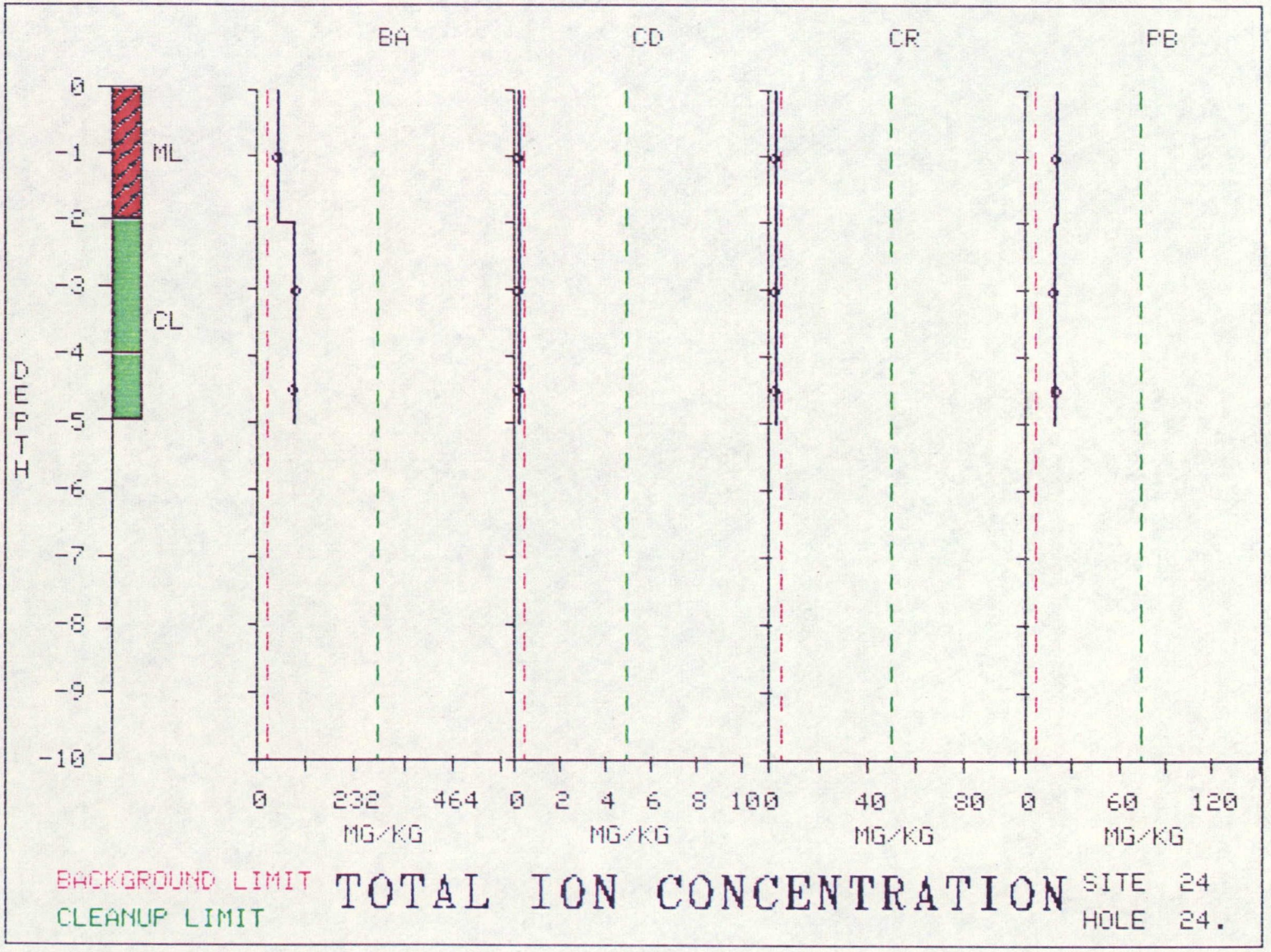
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 23.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464
0
2
4
6
8
100
40
80
0
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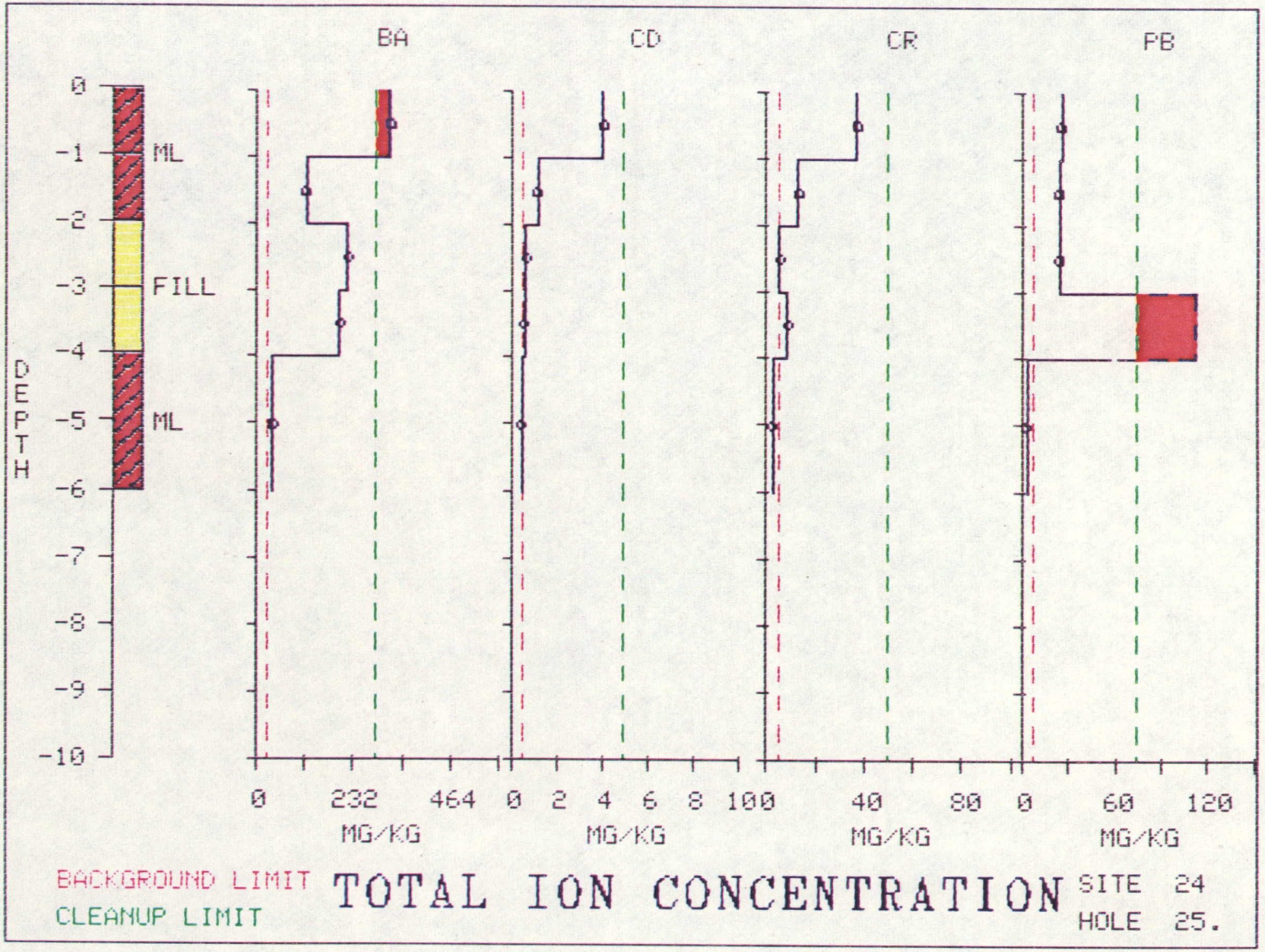
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 24.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464
0
2
4
6
8
100
40
80
0
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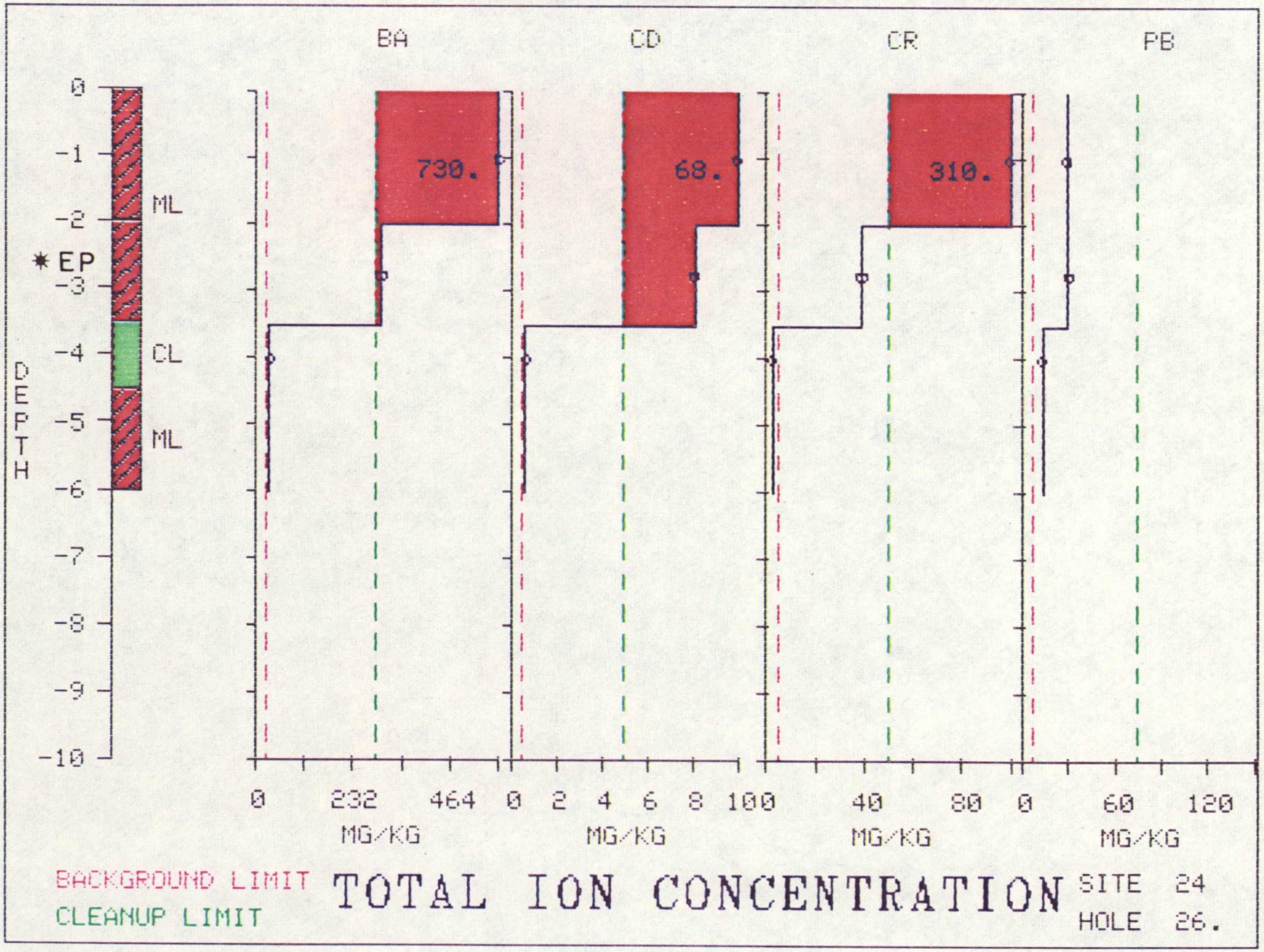
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 25.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EP
ML
CL
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DEPTH
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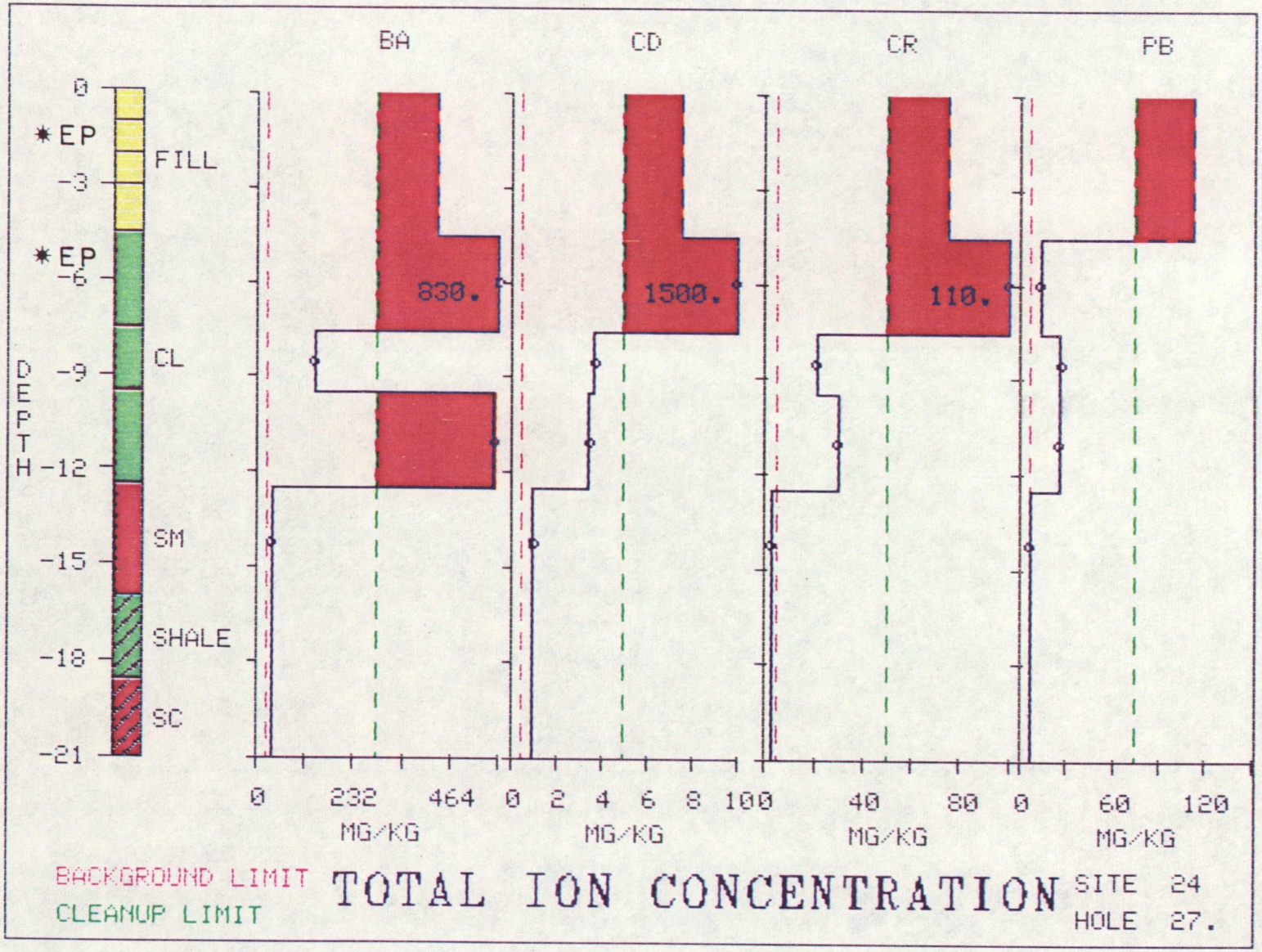
464
0
2
4
6
8
100
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 26.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SHALE
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-21
DEPTH
830.
1500.
110.
0
232
464
0
2
4
6
8
100
40
80
0
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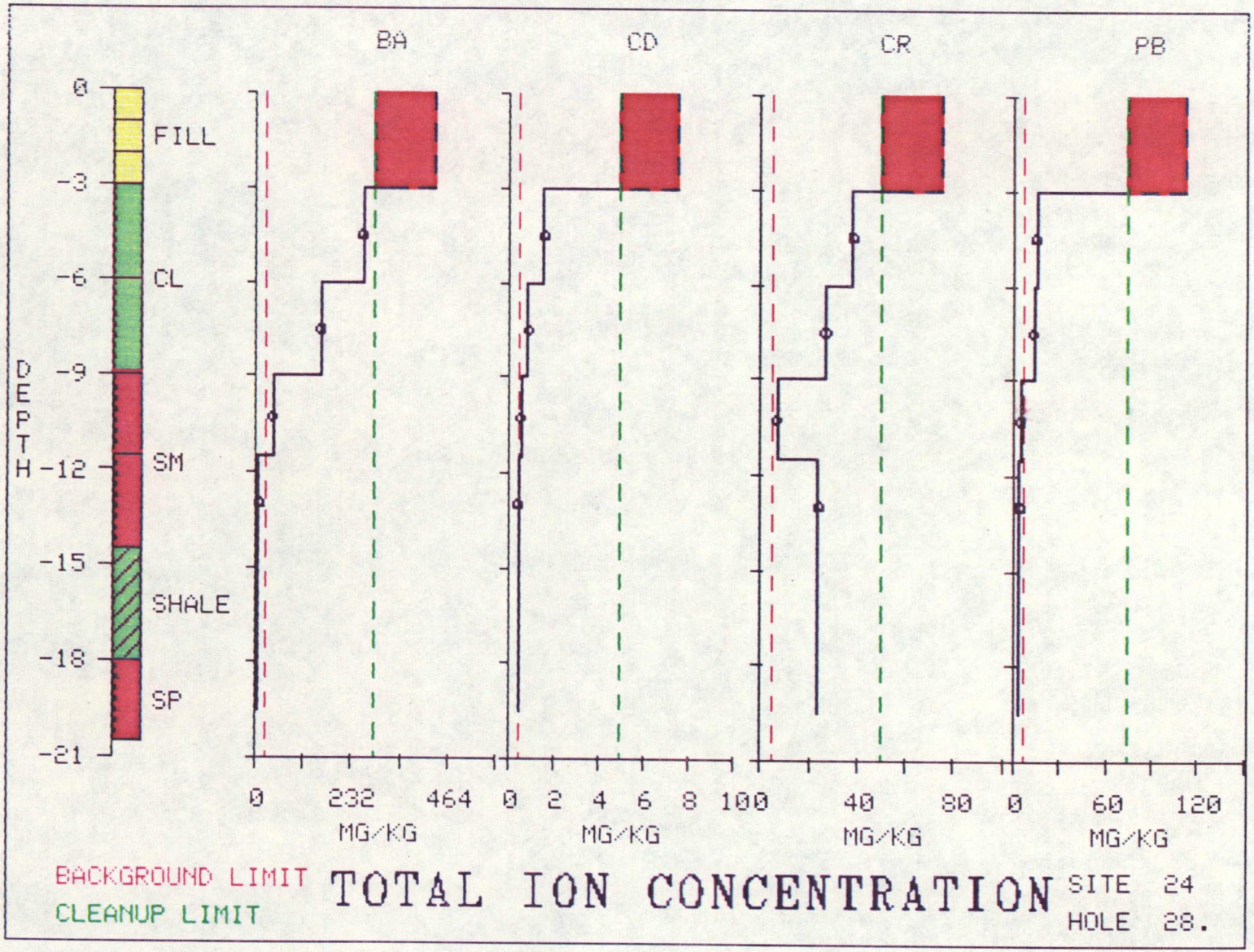
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 27.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FILL
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SM
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464
0
2
4
6
8
100
40
80
0
60
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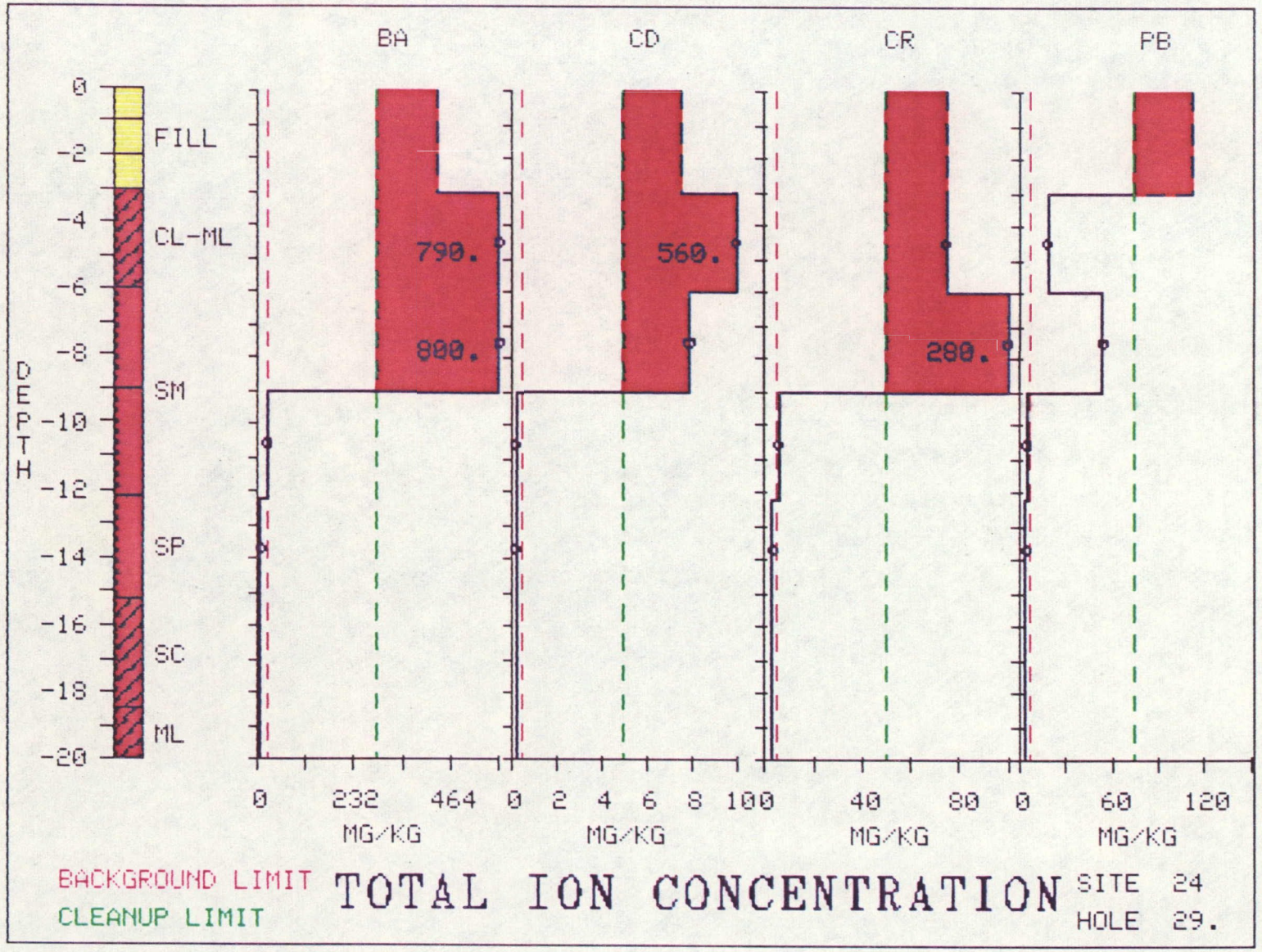
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 28.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SM
SP
SC
ML
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280.
0
232
464
0
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4
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8
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0
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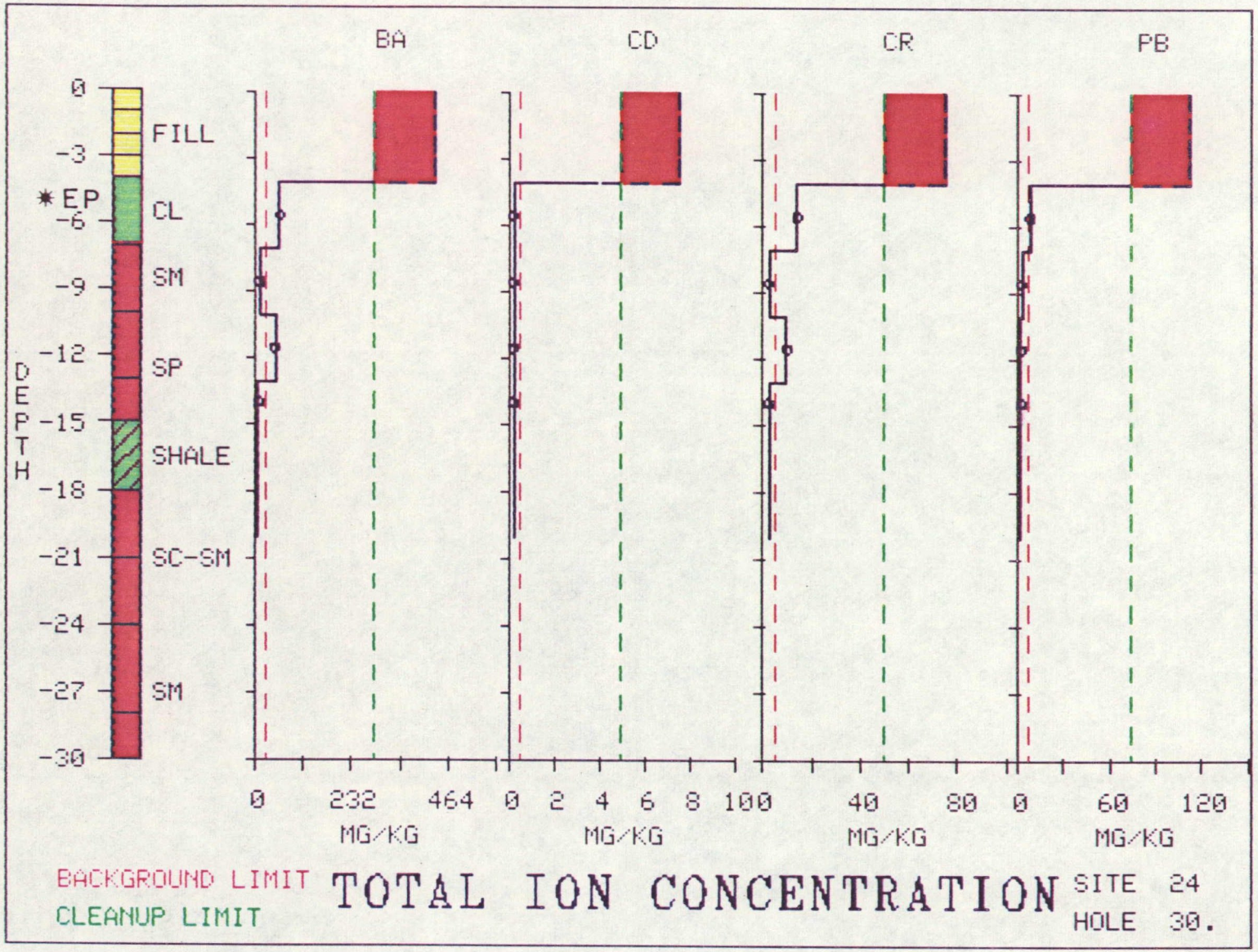
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 29.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FILL
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SP
SHALE
SC-SM
SM
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464
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6
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80
0
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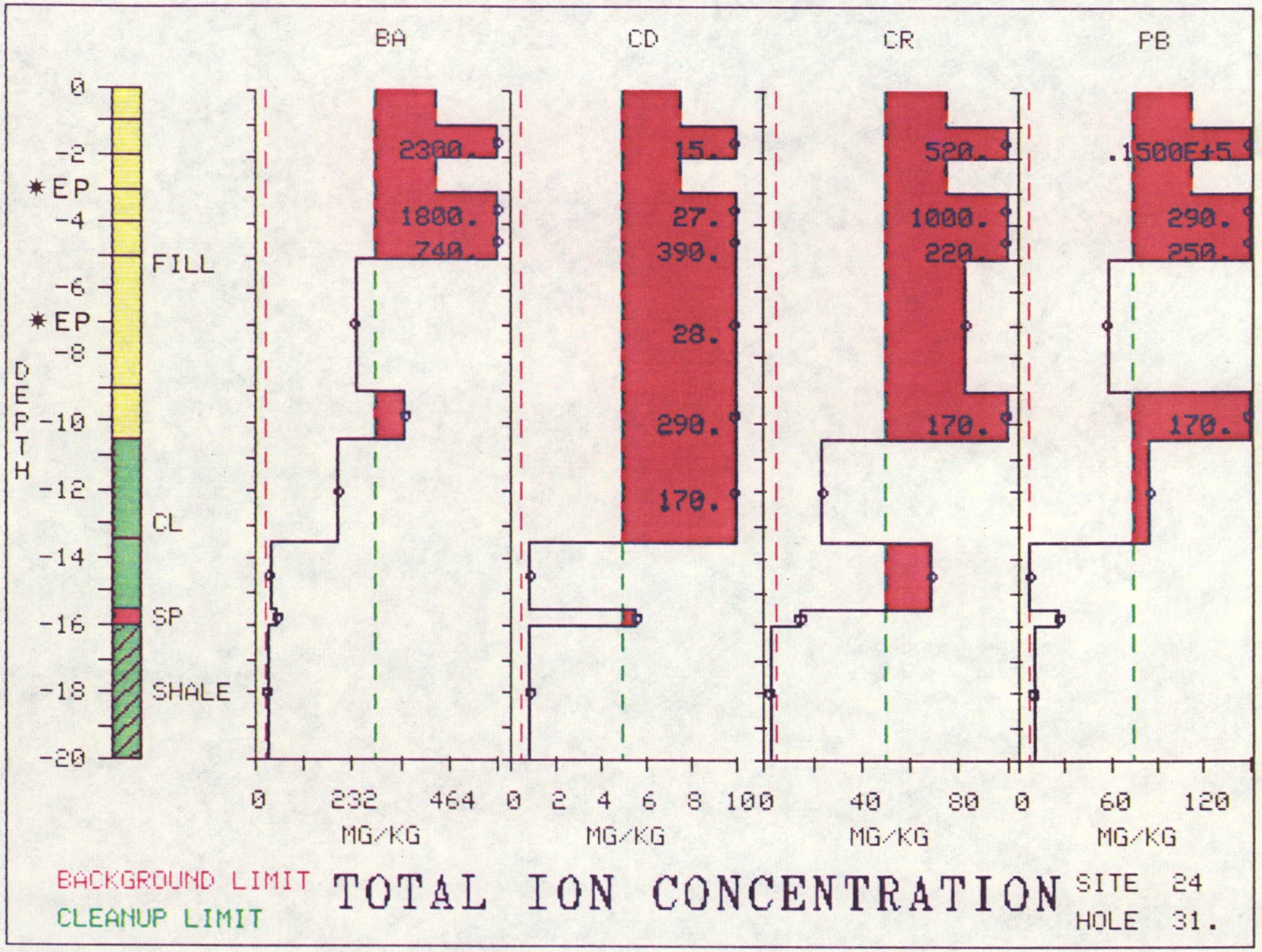
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 30.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SP
-18
SHALE
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1800.
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27.
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28.
290.
170.
520.
1000.
220.
170.
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170.
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464
0
2
4
6
8
100
40
80
0
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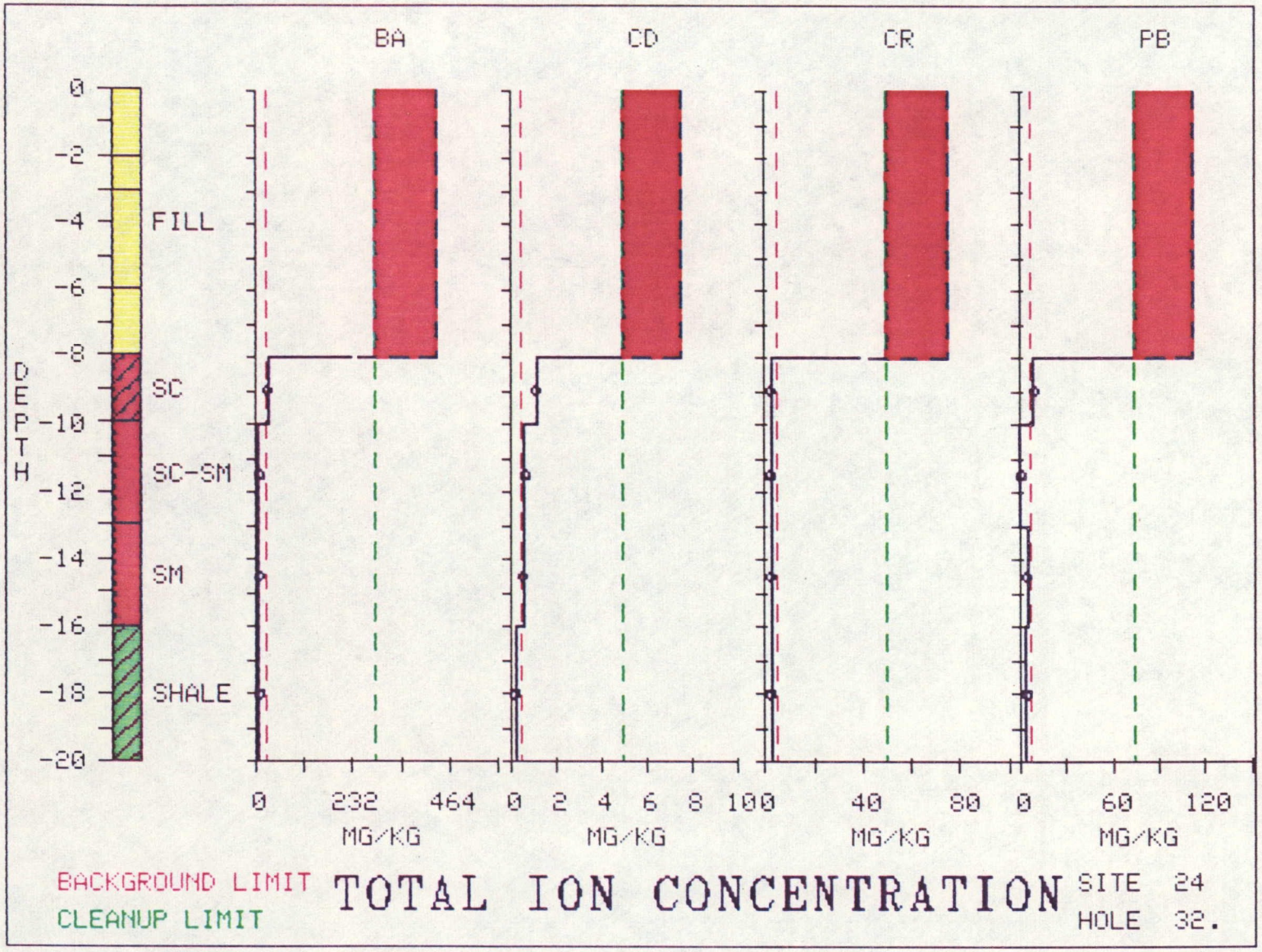
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 31.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-16
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464
0
2
4
6
8
100
40
80
0
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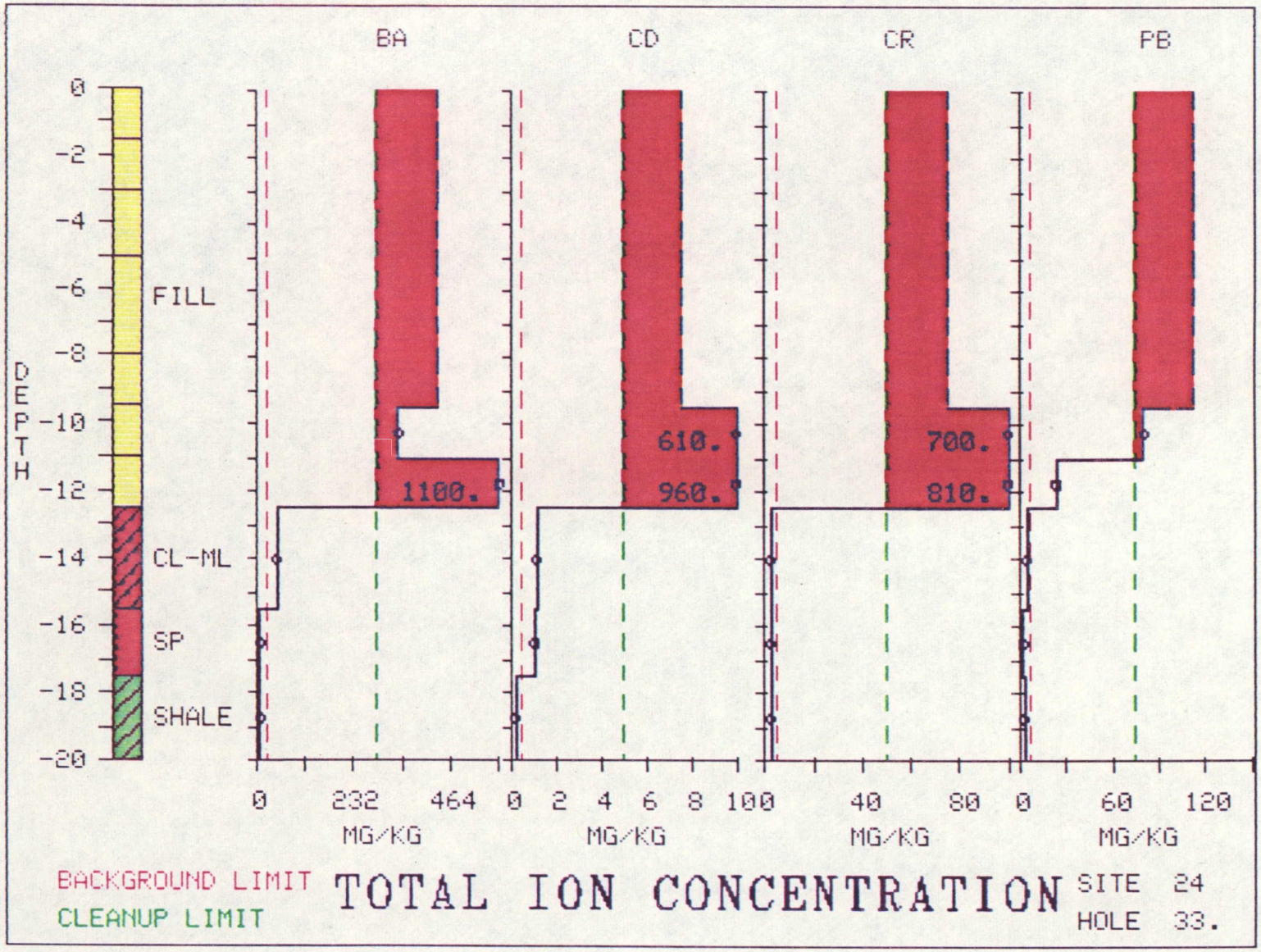
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 32.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CL-ML
SP
SHALE
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960.
700.
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0
232
464
0
2
4
6
8
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80
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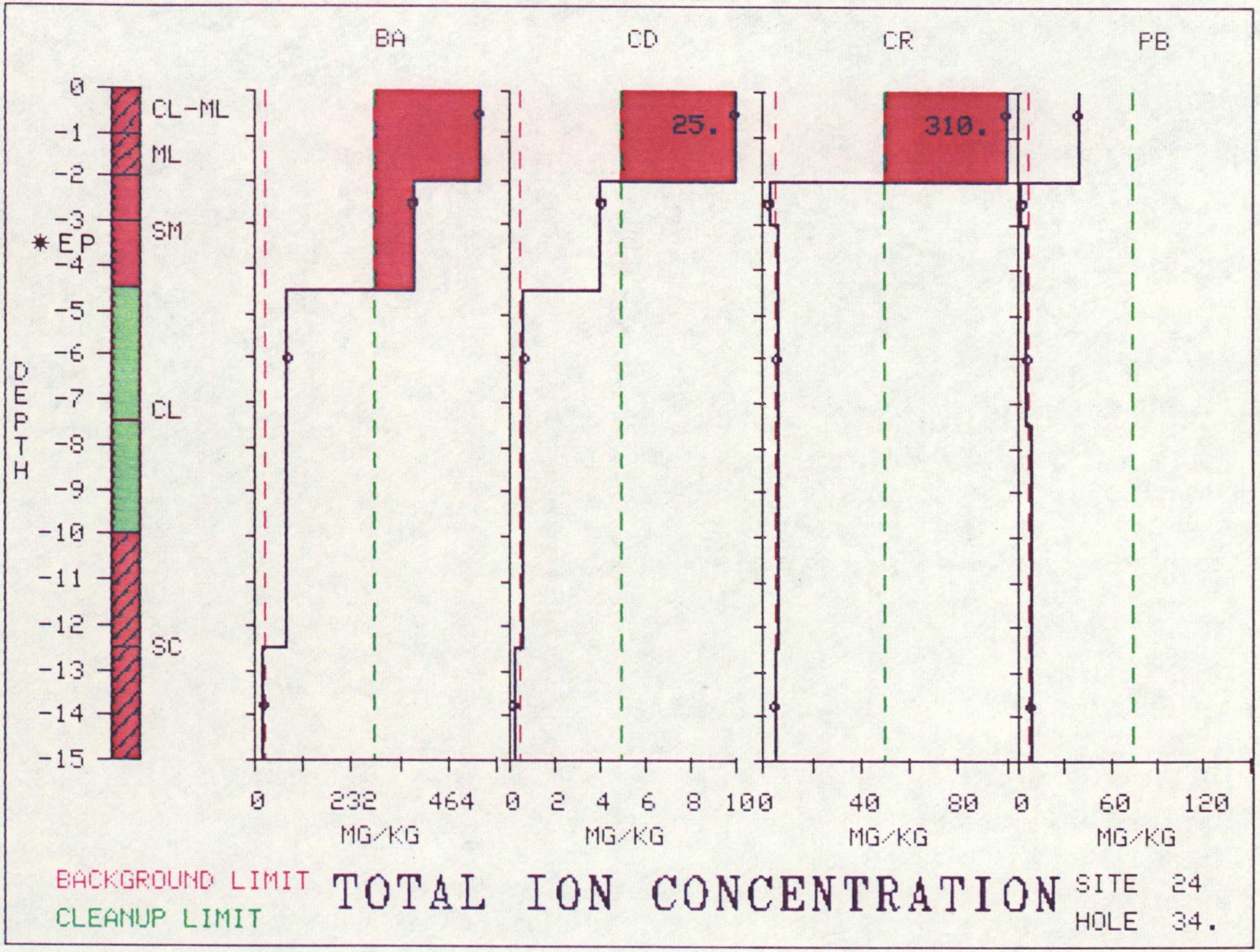
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 33.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-15
EP
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SM
CL
SC
DEPTH
25.
310.
0
232
464
0
2
4
6
8
100
40
80
0
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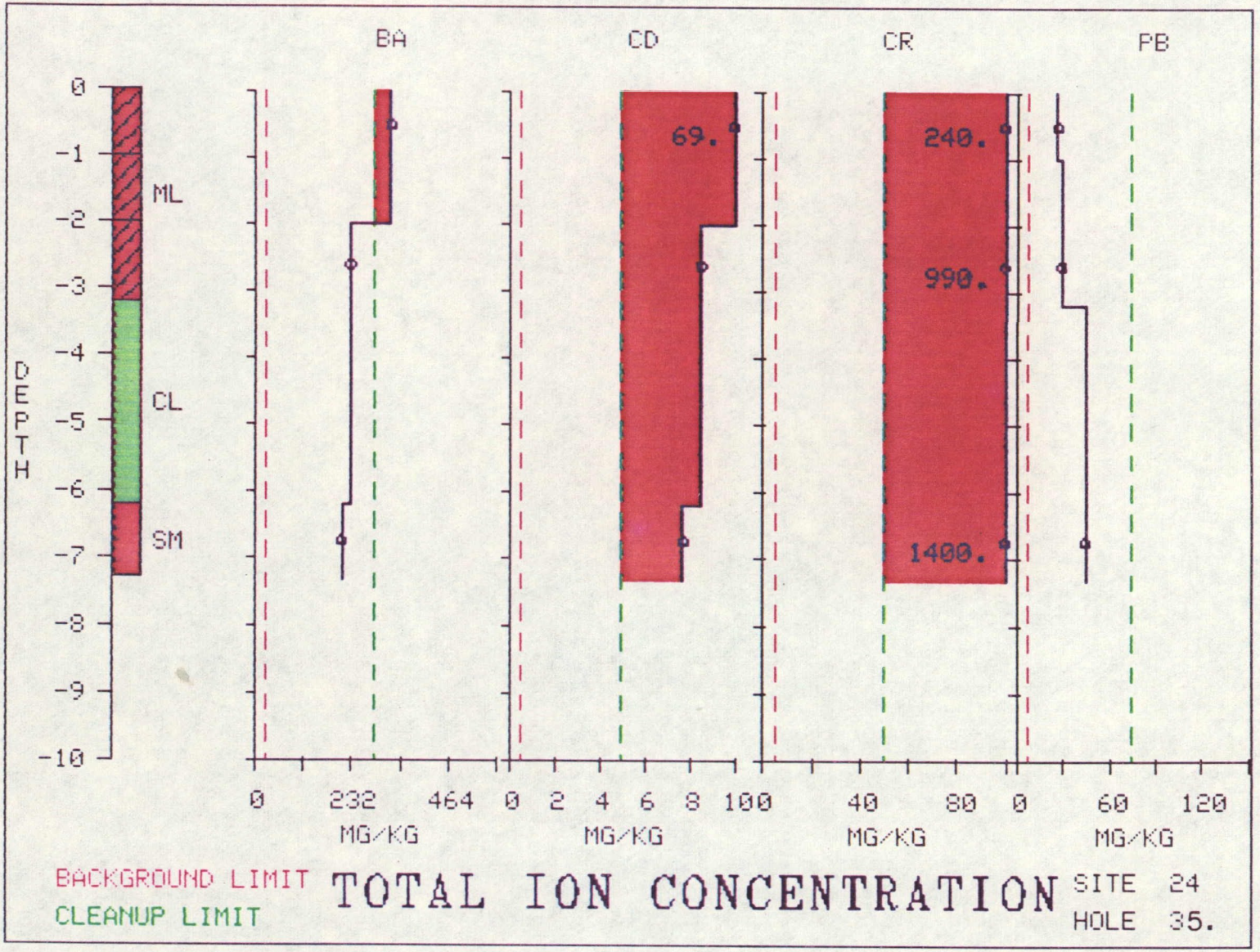
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 34.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-8
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ML
CL
SM
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240.
990.
1400.
0
232
464
0
2
4
6
8
100
40
80
0
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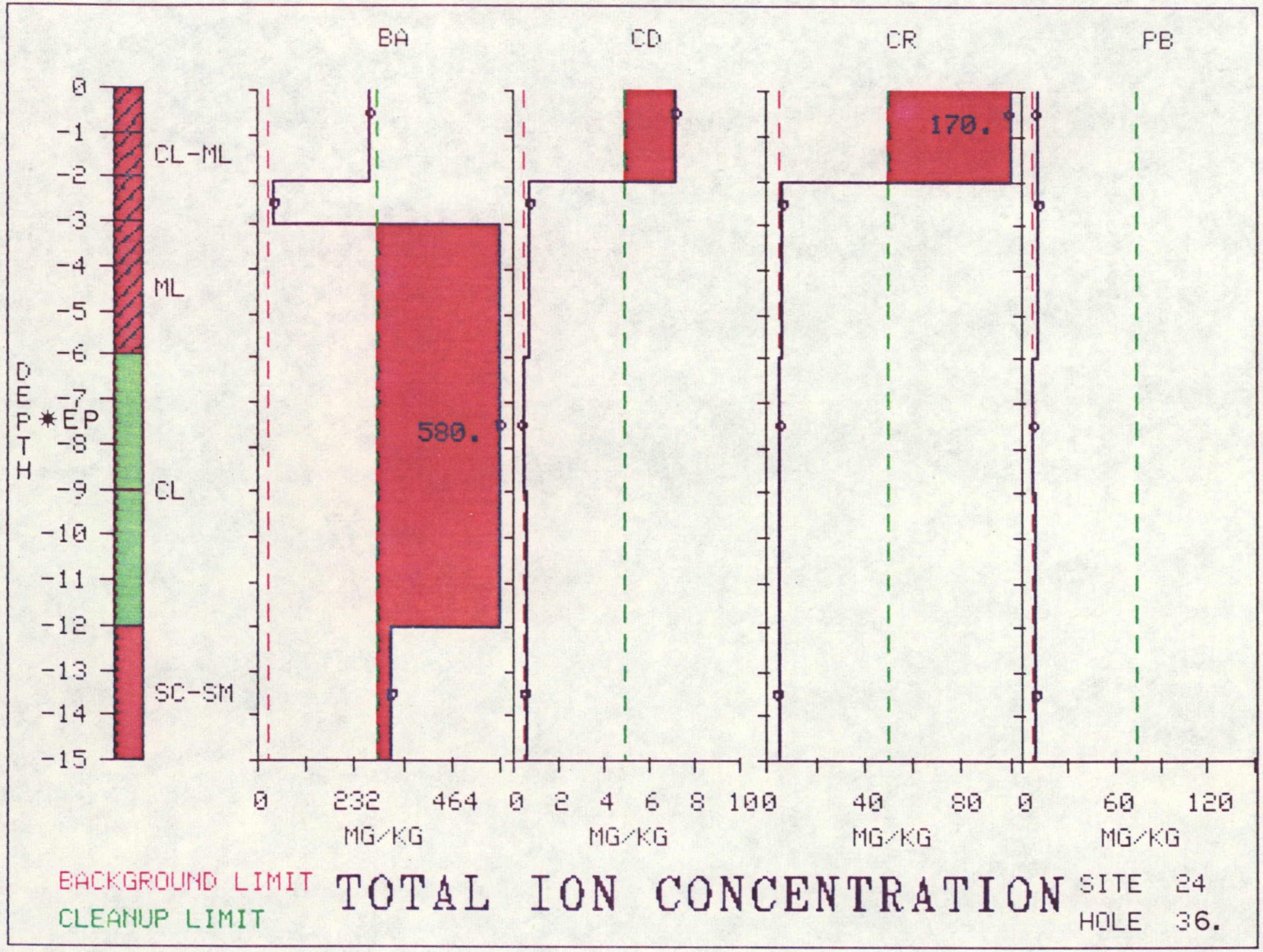
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 35.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SC-SM
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464
0
2
4
6
8
100
40
80
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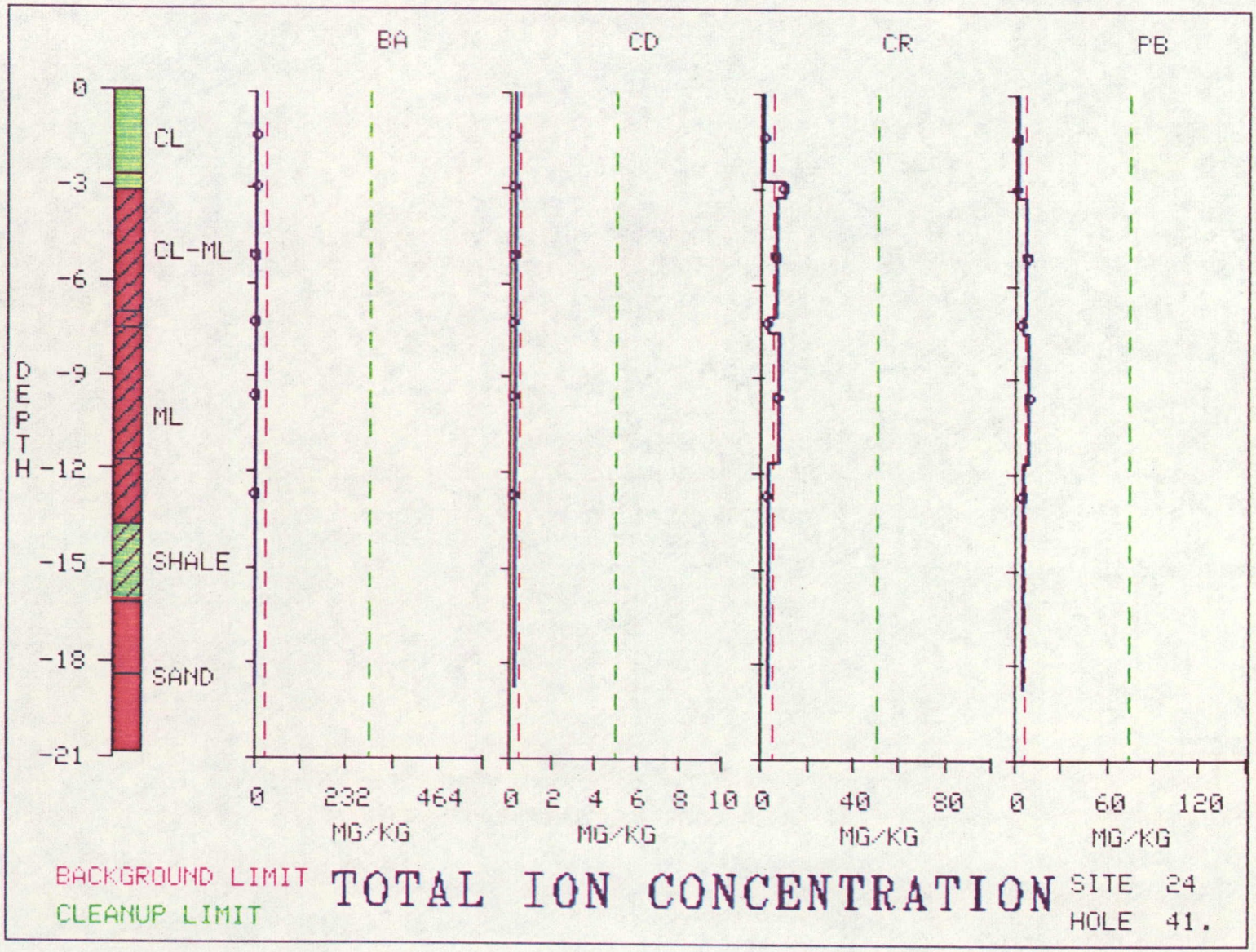
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 36.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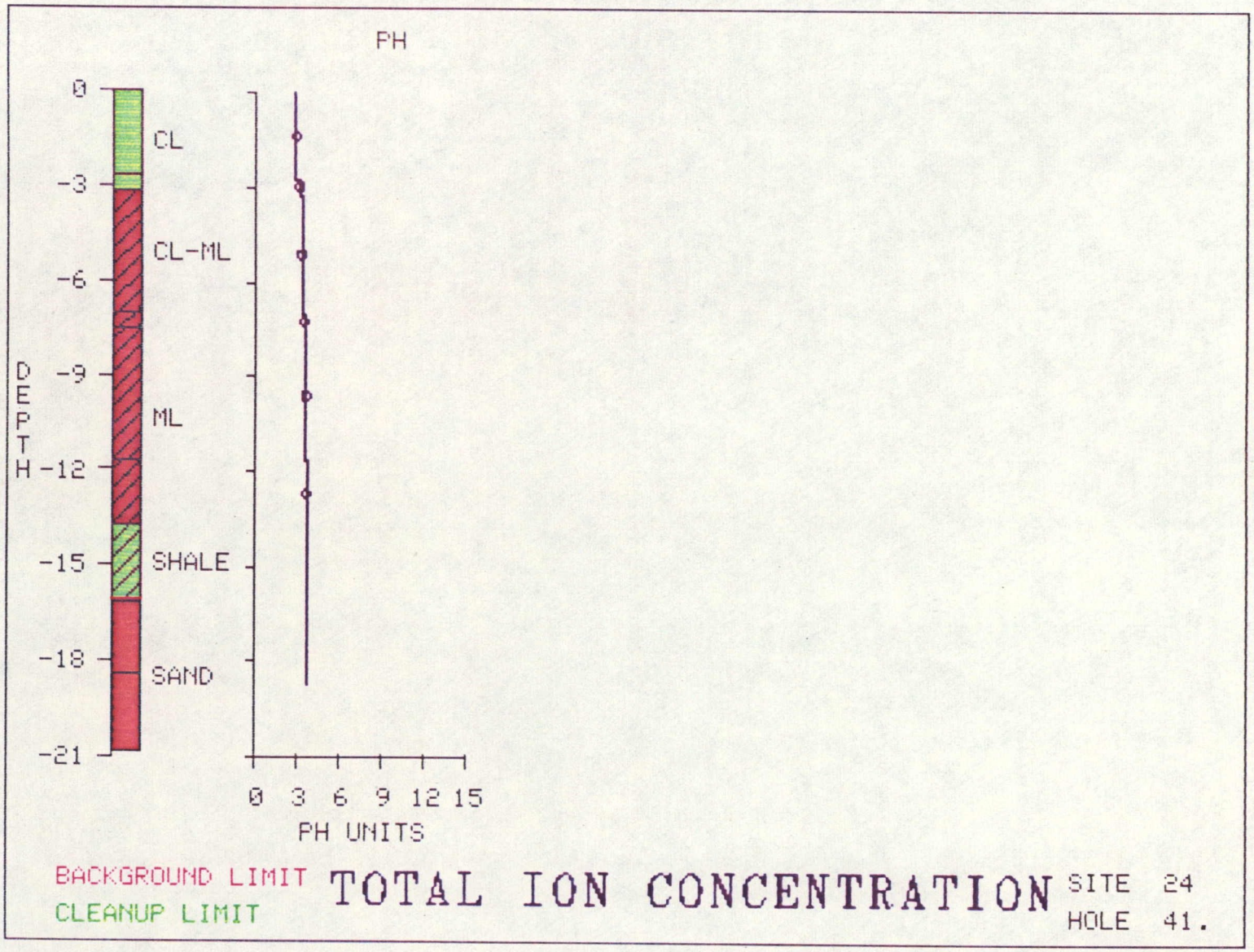
CL
CL-ML
ML
SHALE
SAND
0
232
464
0
2
4
6
8
10
0
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 41.


PH
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DEPTH
CL
CL-ML
ML
SHALE
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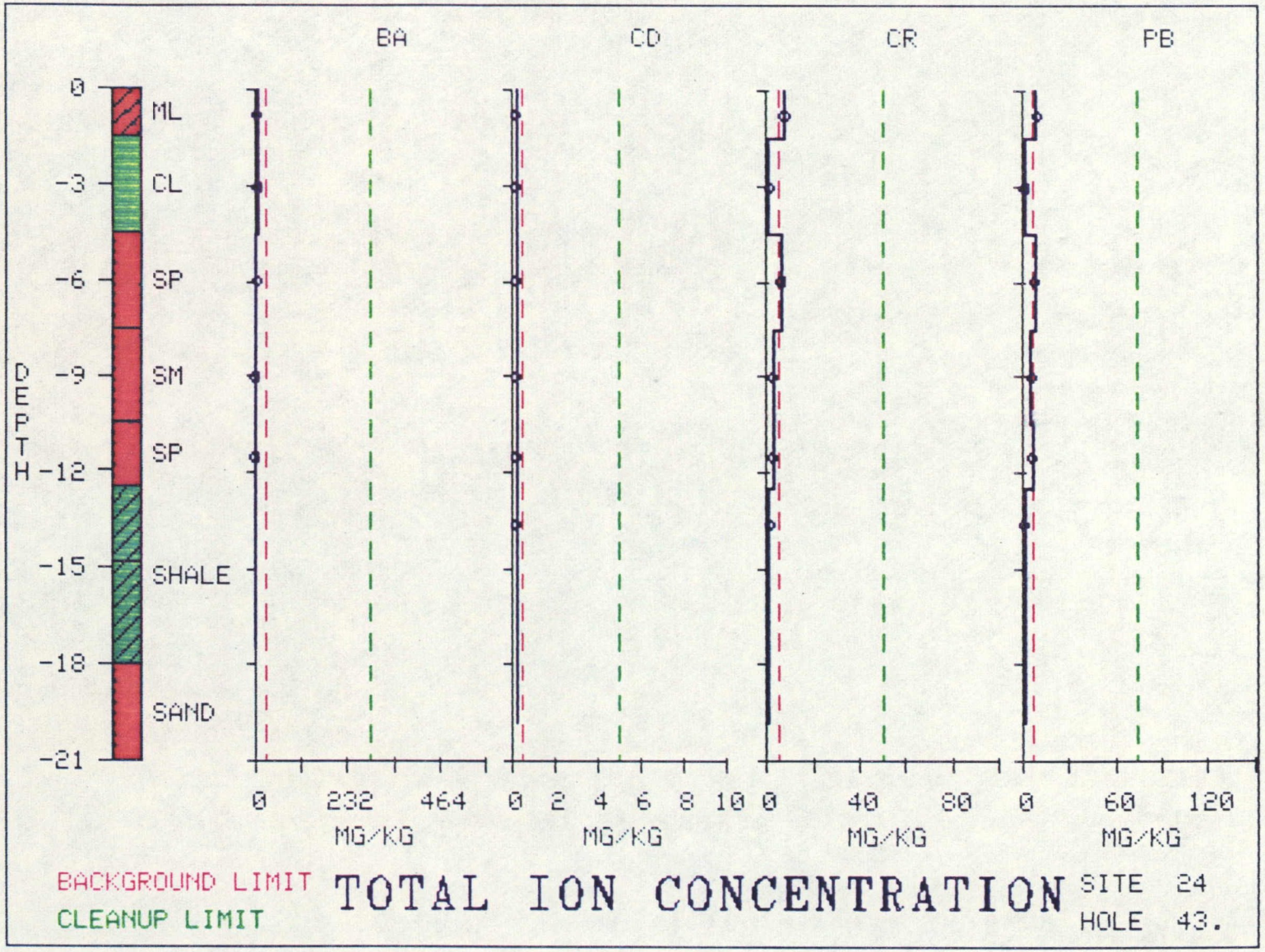
PH UNITS
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 41.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SHALE
SAND
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464
0
2
4
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8
10
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40
80
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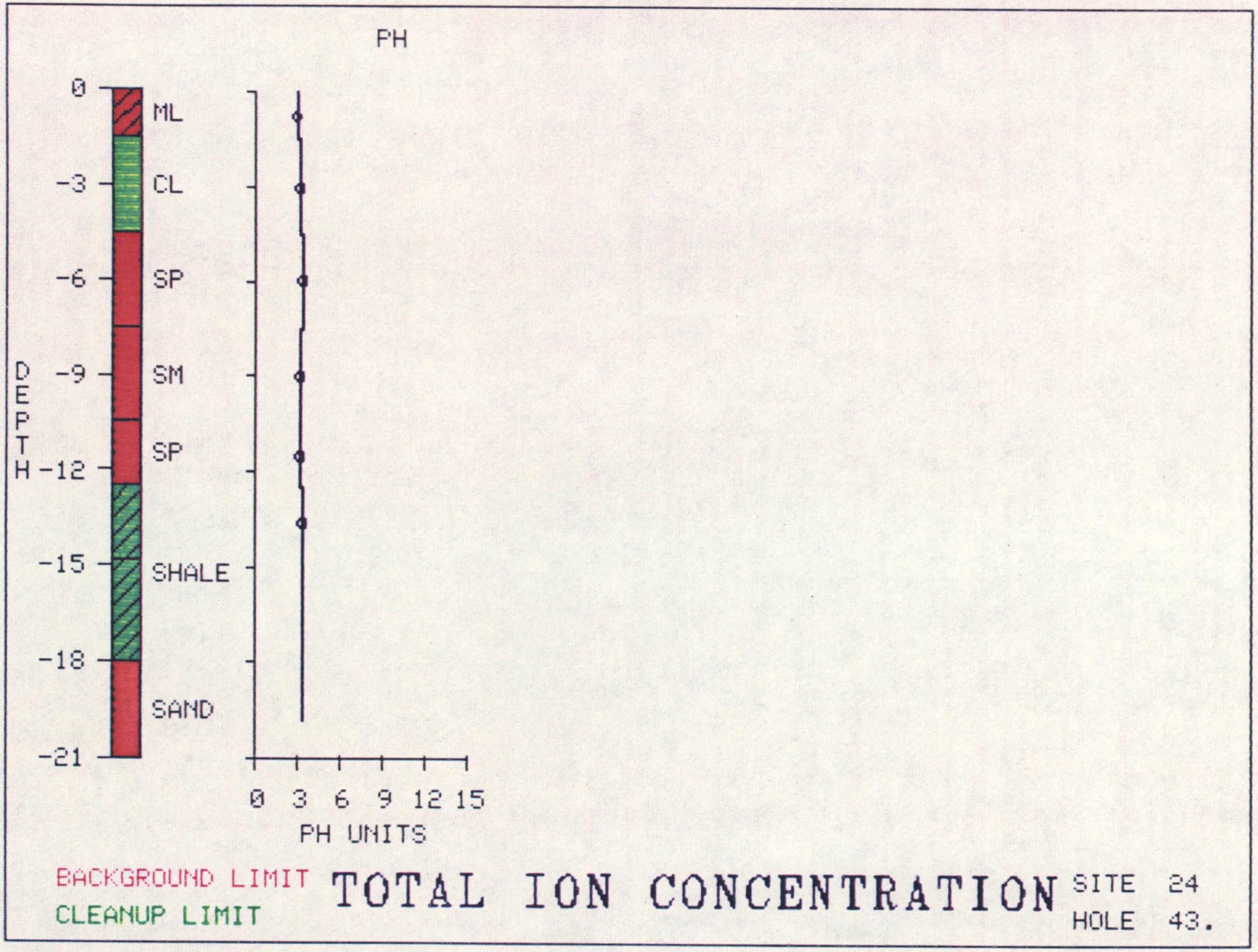
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 43.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SHALE
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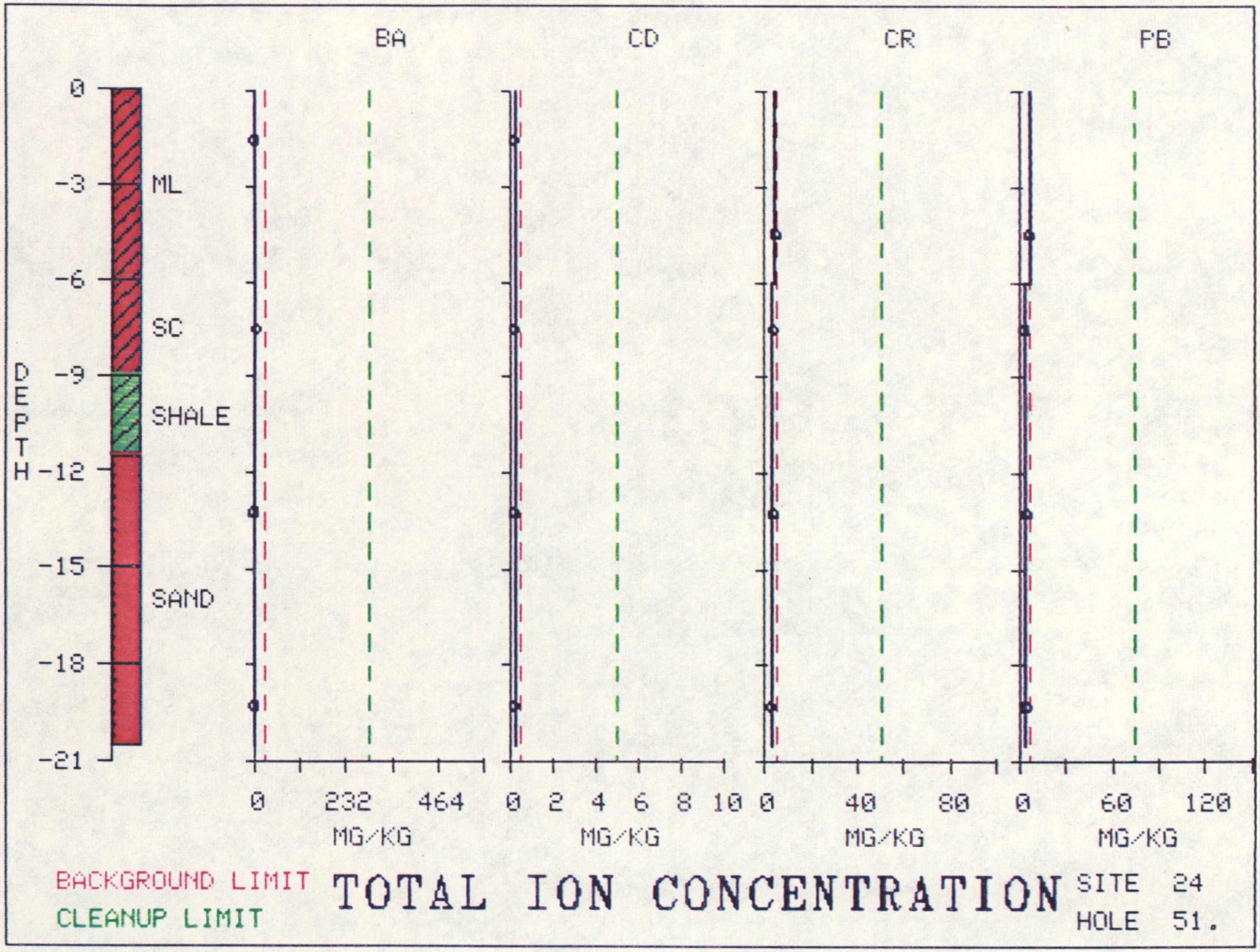
0 3 6 9 12 15
PH UNITS
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 43.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SC
SHALE
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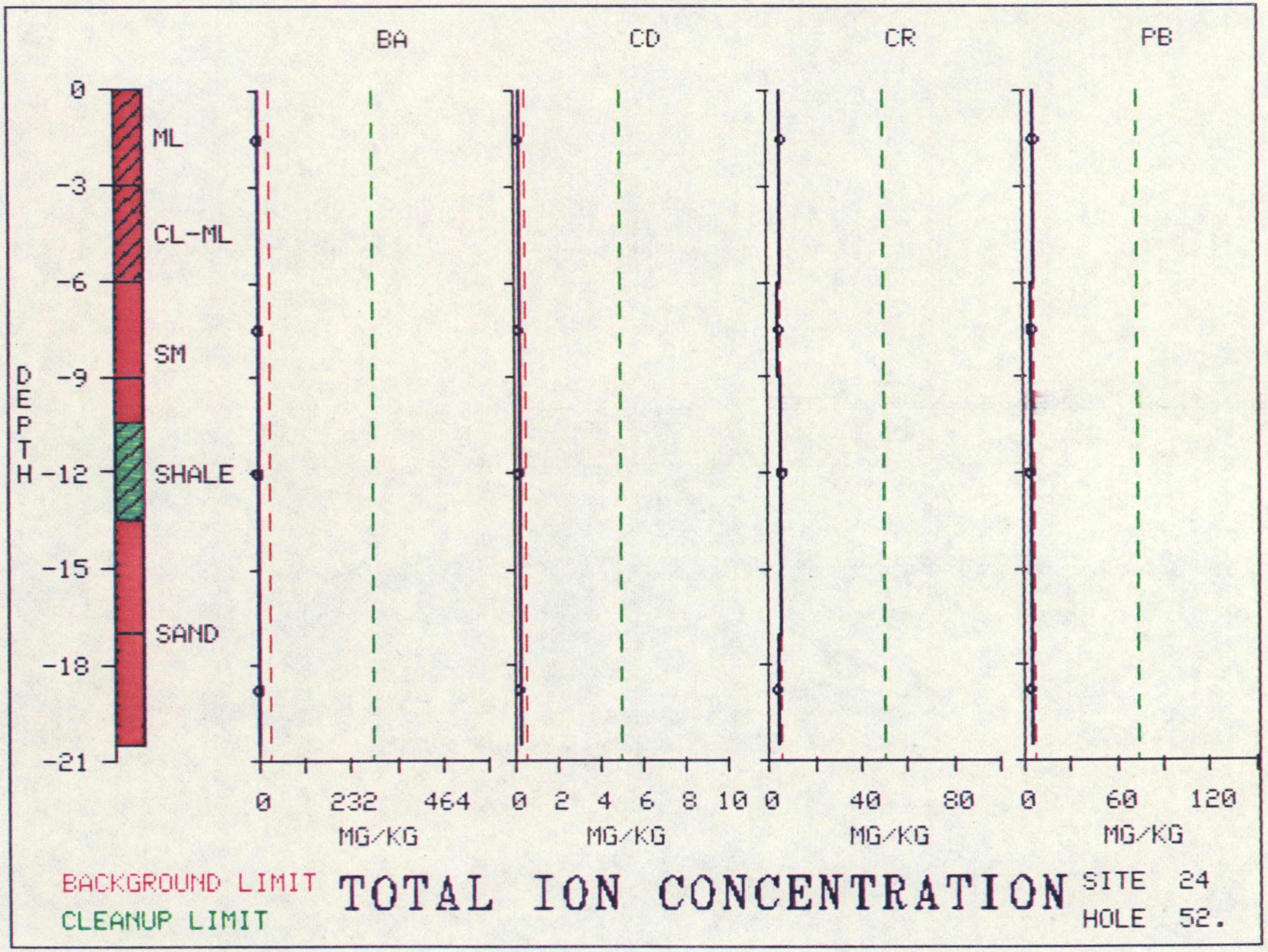
464
0
2
4
6
8
10
0
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 51.


BA
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CR
PB
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-6
-9
-12
-15
-18
-21
DEPTH
ML
CL-ML
SM
SHALE
SAND
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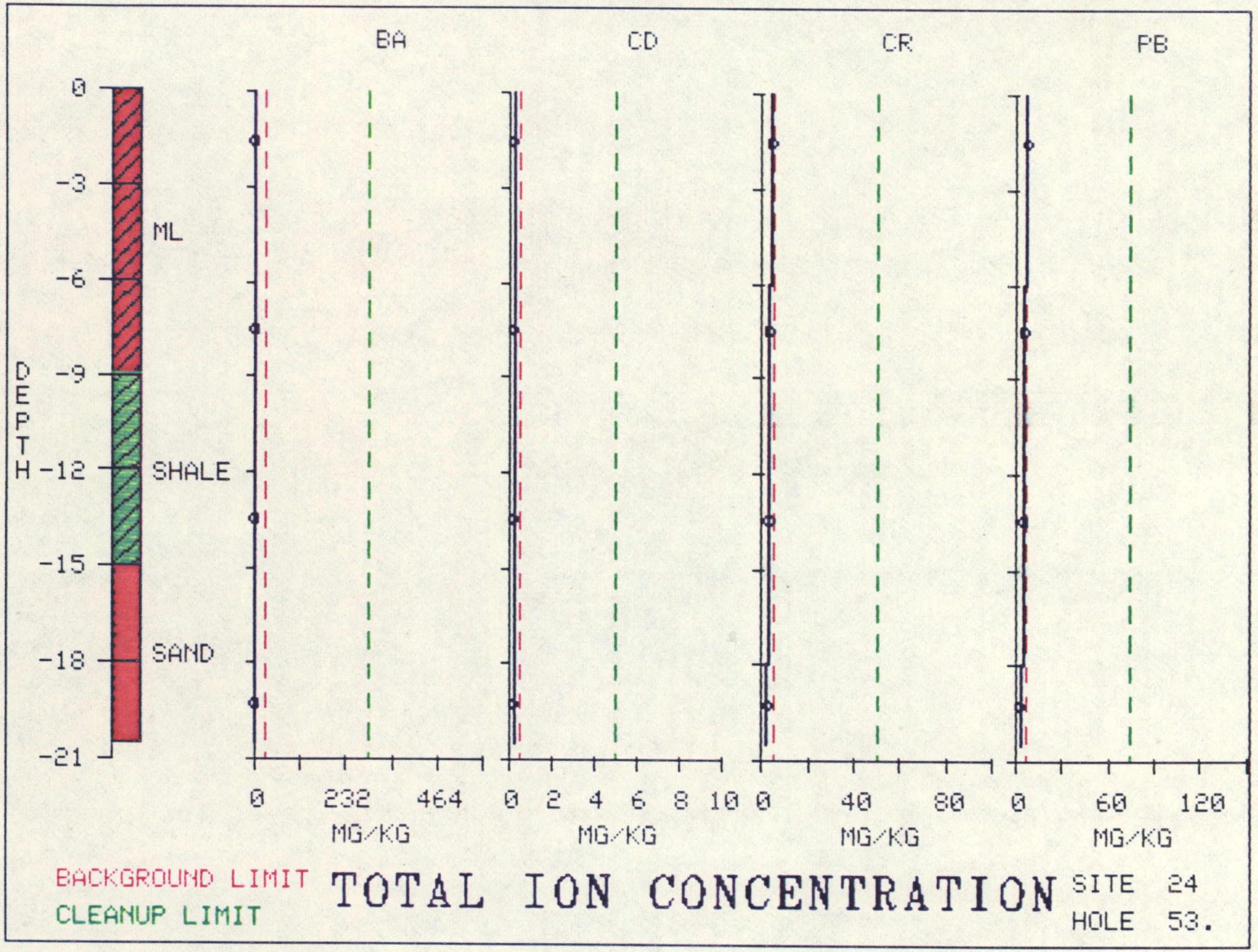
232
464
0
2
4
6
8
10
0
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 52.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PB
DEPTH
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-6
-9
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-21
ML
SHALE
SAND
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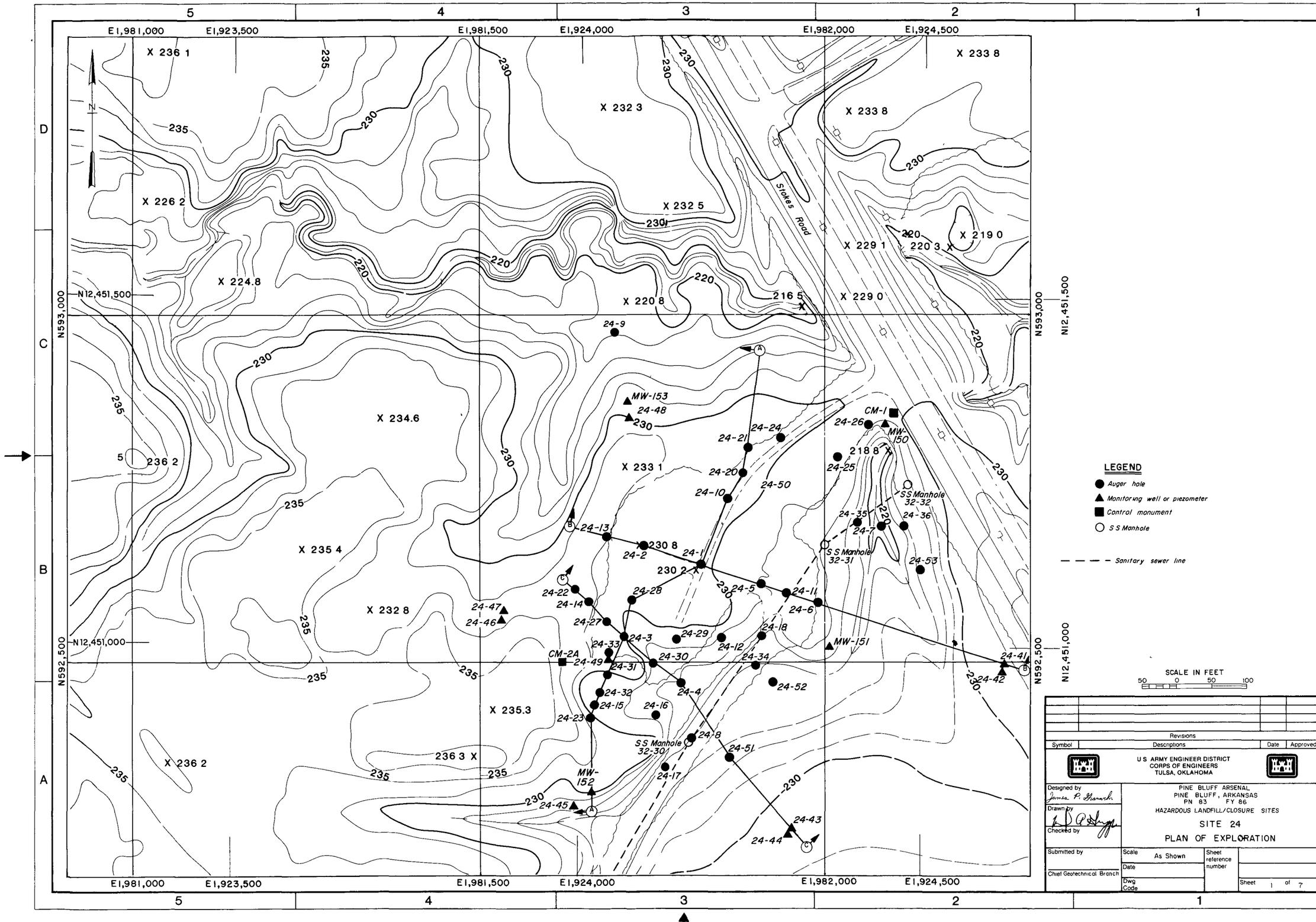
0
2
4
6
8
10
0
40
80
0
60
120
MG/KG
MG/KG
MG/KG
MG/KG
BACKGROUND LIMIT
CLEANUP LIMIT
TOTAL ION CONCENTRATION
SITE 24
HOLE 53.

DRAWINGS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N12,451,000
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X 232 3
X 233 8
X 226 2
X 232 5
X 219 0
X 229 1
X 224.8
X 220 8
X 229 0
X 234.6
X 233 1
X 235 4
X 232 8
X 235.3
X 236 2
236 3 X
230 8
230 2 X
218 8
Stokes Road
24-9
24-48
24-21
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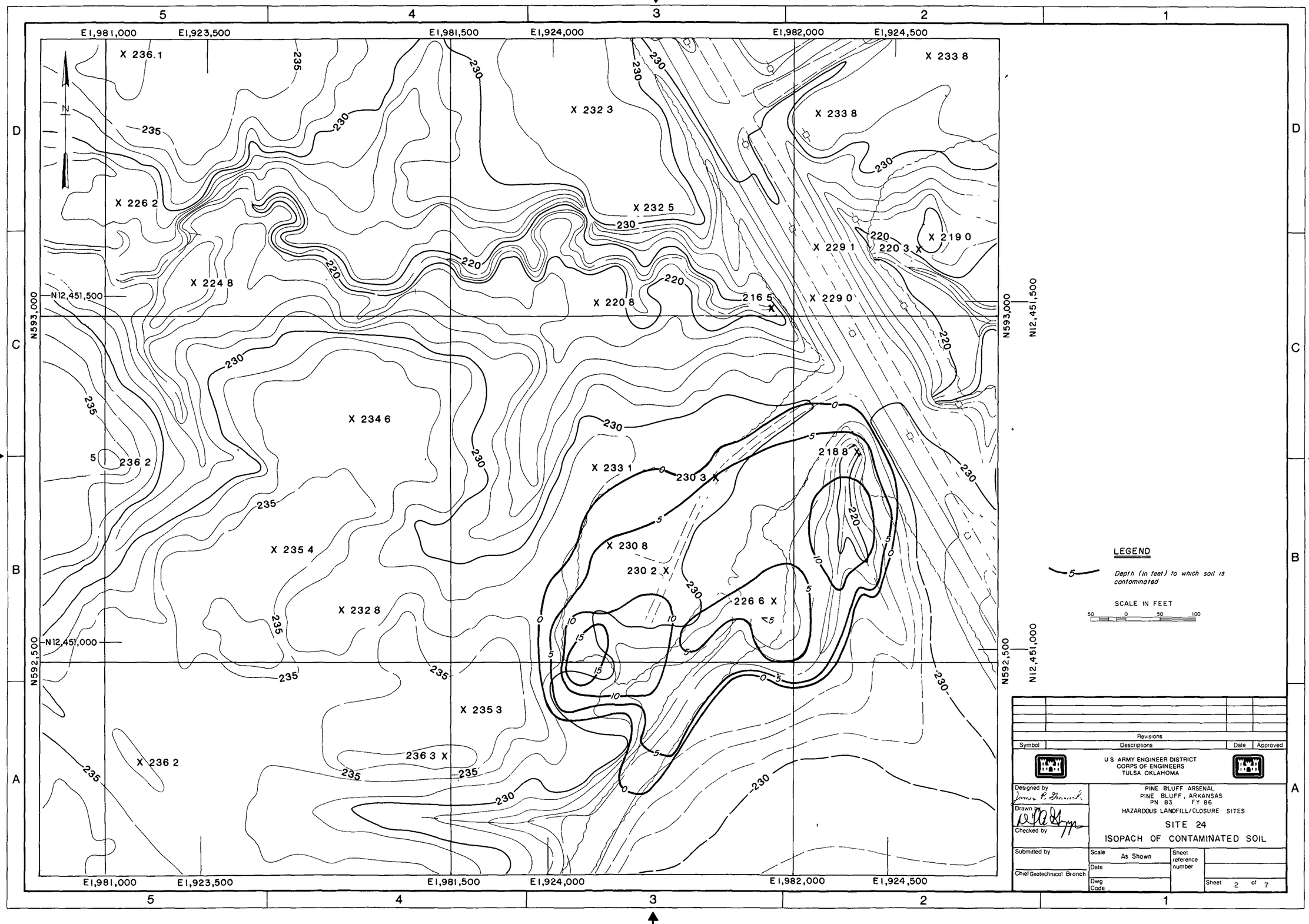
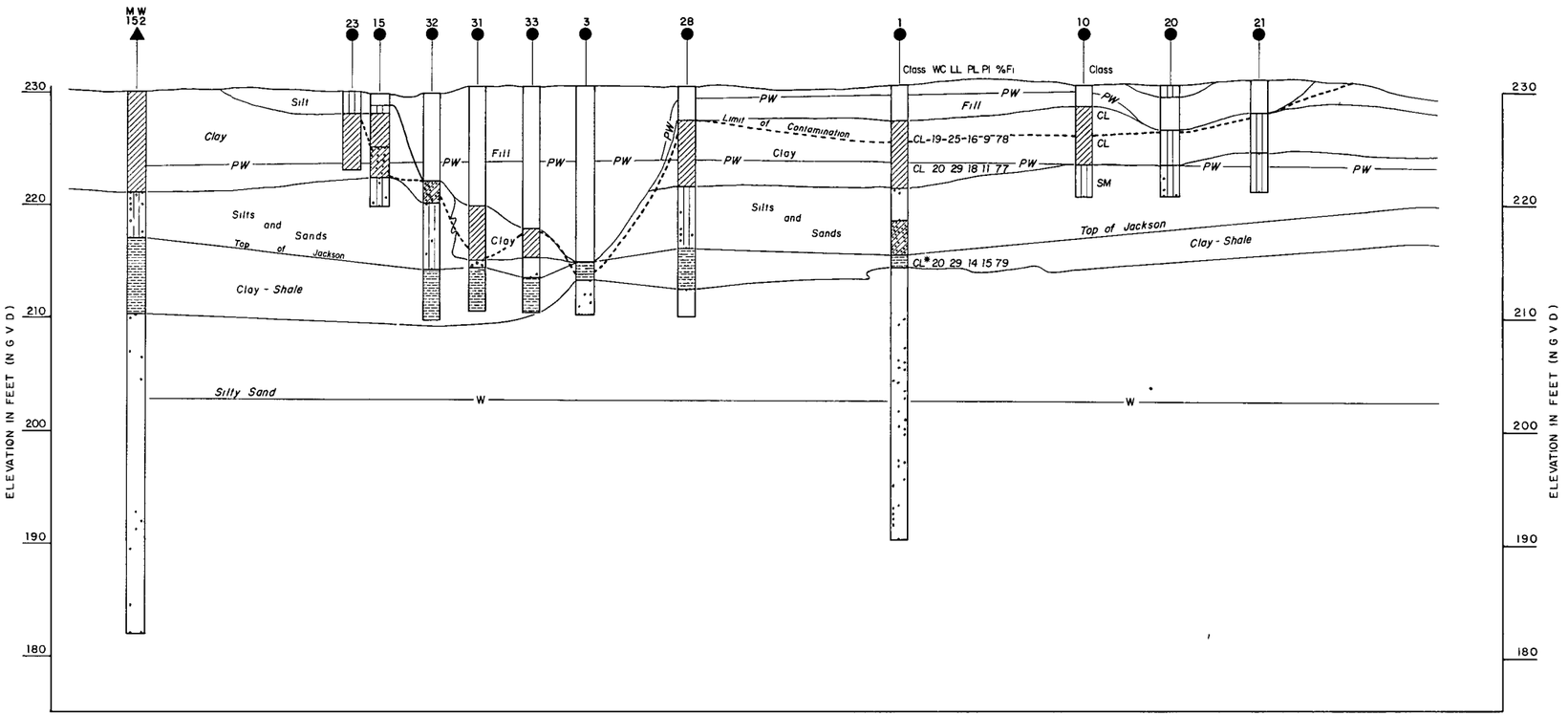
24-36
24-53
MW-153
MW-150
MW-151
MW-152
CM-1
CM-2A
SS Manhole 32-32
SS Manhole 32-31
SS Manhole 32-30
LEGEND
Auger hole
Monitoring well or piezometer
Control monument
S S Manhole
Sanitary sewer line
SCALE IN FEET
50 0 50 100
Revisions
Symbol | Descriptions | Date | Approved
U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA, OKLAHOMA
Designed by James P. Branch
Drawn by
Checked by
PINE BLUFF ARSENAL
PINE BLUFF, ARKANSAS
PN 83 FY 86
HAZARDOUS LANDFILL/CLOSURE SITES
SITE 24
PLAN OF EXPLORATION
Submitted by
Chief Geotechnical Branch
Scale As Shown
Date
Dwg Code
Sheet reference number
Sheet 1 of 7


E1,981,000
E1,923,500
E1,981,500
E1,924,000
E1,982,000
E1,924,500
N593,000
N12,451,500
N592,500
N12,451,000
X 236.1
X 233 8
X 232 3
X 233 8
X 226 2
X 232 5
X 219 0
X 229 1
220 3 X
X 224 8
X 220 8
216 5 X
X 229 0
X 234 6
236 2
X 233 1
230 3 X
218 8 X
X 235 4
X 230 8
230 2 X
226 6 X
X 232 8
X 235 3
236 3 X
X 236 2
LEGEND
Depth (in feet) to which soil is contaminated
SCALE IN FEET
50 0 50 100
Revisions
Symbol
Descriptions
Date
Approved
U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA OKLAHOMA
Designed by James P. Branch
Drawn by
Checked by
Submitted by
Chief Geotechnical Branch
PINE BLUFF ARSENAL
PINE BLUFF, ARKANSAS
PN 83 FY 86
HAZARDOUS LANDFILL/CLOSURE SITES
SITE 24
ISOPACH OF CONTAMINATED SOIL
Scale As Shown
Date
Dwg Code
Sheet reference number
Sheet 2 of 7



GEOLOGIC SECTION A-A - SITE 24

SCALE IN FEET

30 0 30 60

LEGEND

- AUGER HOLE
- MONITORING WELL
- * SOIL CLASSIFICATION PERFORMED ON CLAY-SHALE
- -W- WATER TABLE
- -PW- PERCHED WATER
- ----- LIMITS OF CONTAMINATION

- FILL MATERIAL
- CL, LOW PLASTICITY CLAY
- SC, CLAYEY SAND
- ML, CL-ML, SILT, CLAYEY SILT
- SM, SILTY SAND
- SP, SAND
- CLAY - SHALE
- SAND/ SANDSTONE

Class UNIFIED SOIL CLASSIFICATION SYSTEM
WC WATER CONTENT
LL LIQUID LIMIT
PL PLASTIC LIMIT
PI PLASTICITY INDEX
%FI PERCENT FINES

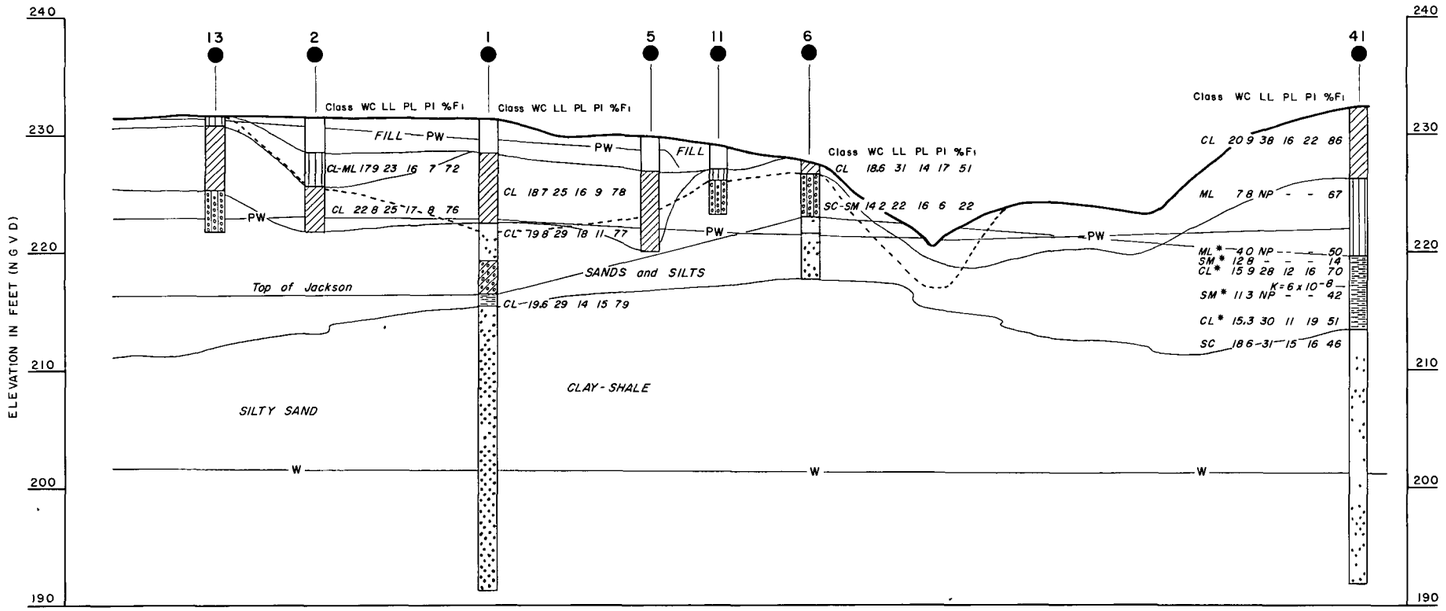
Revisions			
Symbol	Descriptions	Date	Approved

US ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA, OKLAHOMA

Designed by James P Bramwell
Drawn by
Checked by
Submitted by
Chief Geotechnical Branch

PINE BLUFF ARSENAL
PINE BLUFF, ARKANSAS
PN 83 FY 86
HAZARDOUS LANDFILL/CLOSURE SITES
SITE 24
GEOLOGIC SECTION A-A

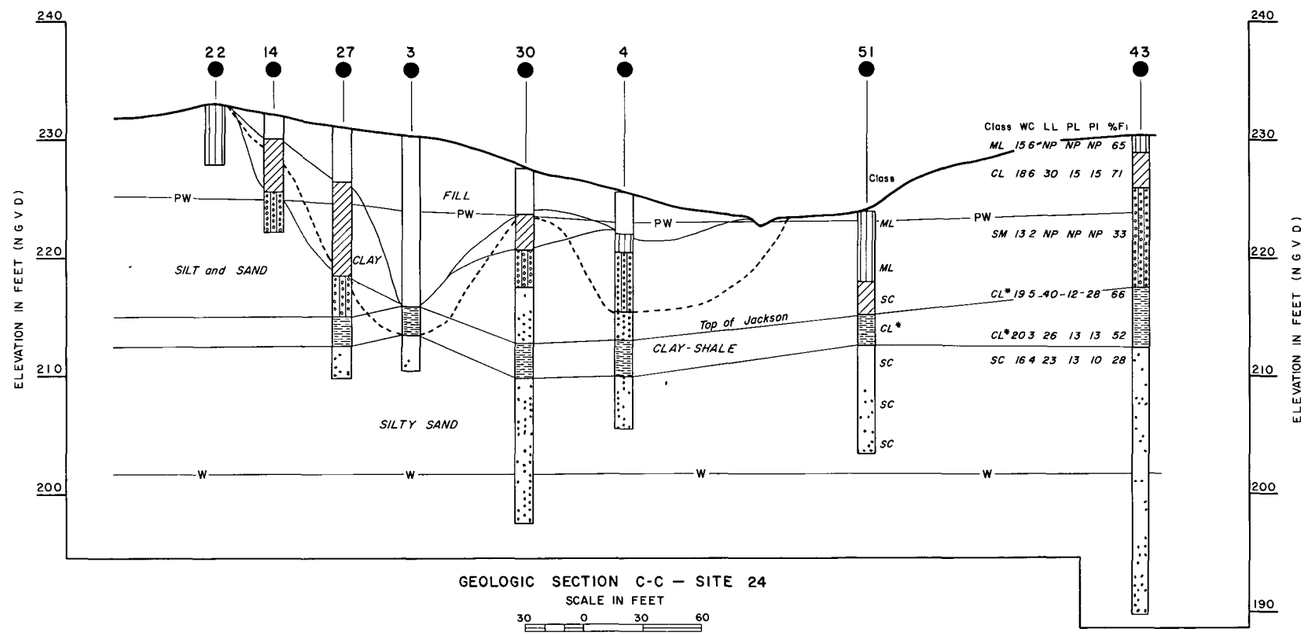
Scale As Shown
Date
Dwg Code
Sheet reference number
Sheet 3 of 7



GEOLOGIC SECTION B-B — SITE 24

SCALE IN FEET

30 0 30 60



GEOLOGIC SECTION C-C — SITE 24

SCALE IN FEET

30 0 30 60

For Legend, See drawing no 3

Revisions			
Symbol	Descriptions	Date	Approved

U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA OKLAHOMA

Designed by

Drawn by Darrell Jones

Checked by

Submitted by

Chief Geotechnical Branch

PINE BLUFF ARSENAL
PINE BLUFF, ARKANSAS
PN 83 FY 86
HAZARDOUS LANDFILL/CLOSURE SITES

SITE 24
GEOLOGIC SECTION B-B & C-C

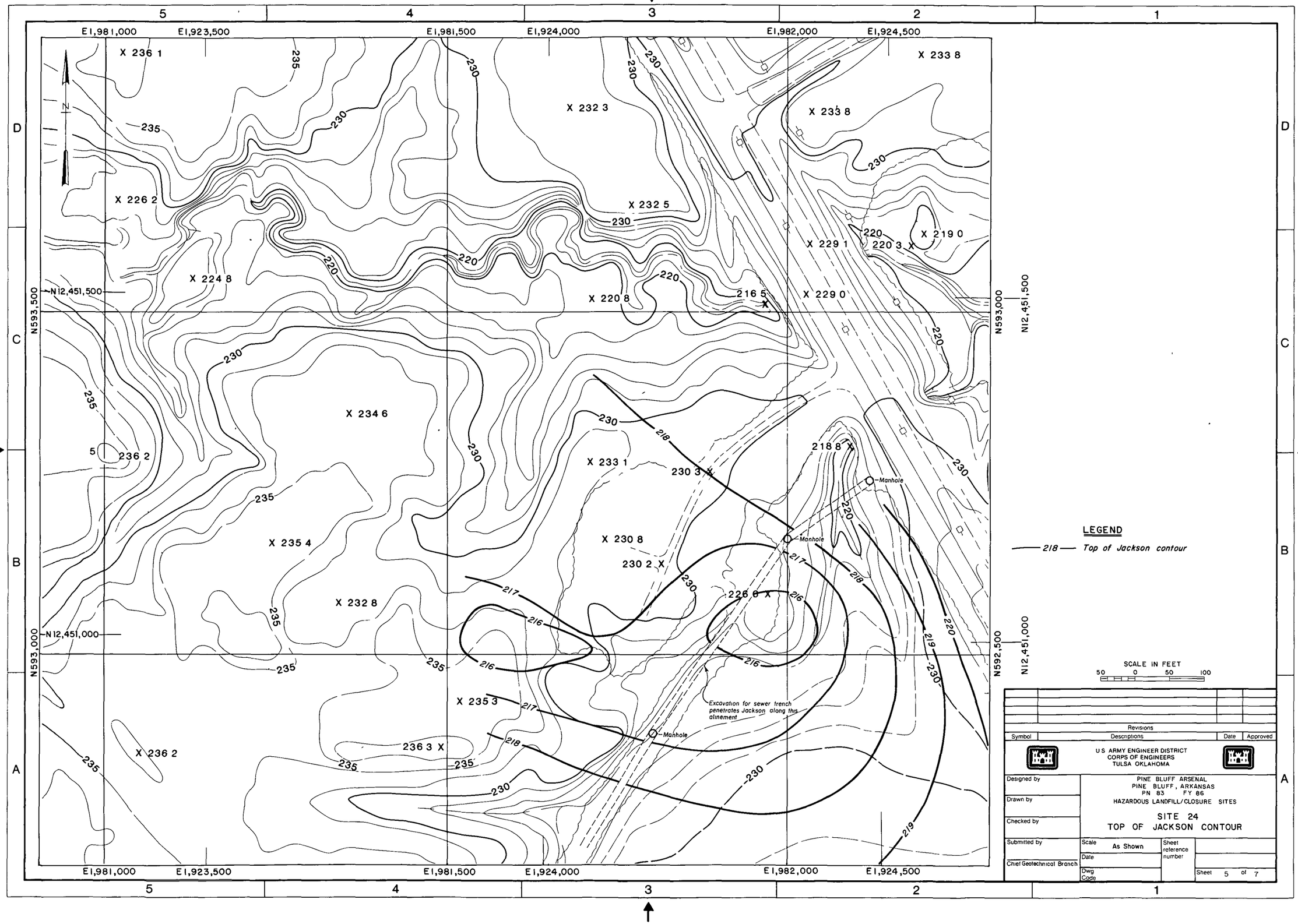
Scale As Shown

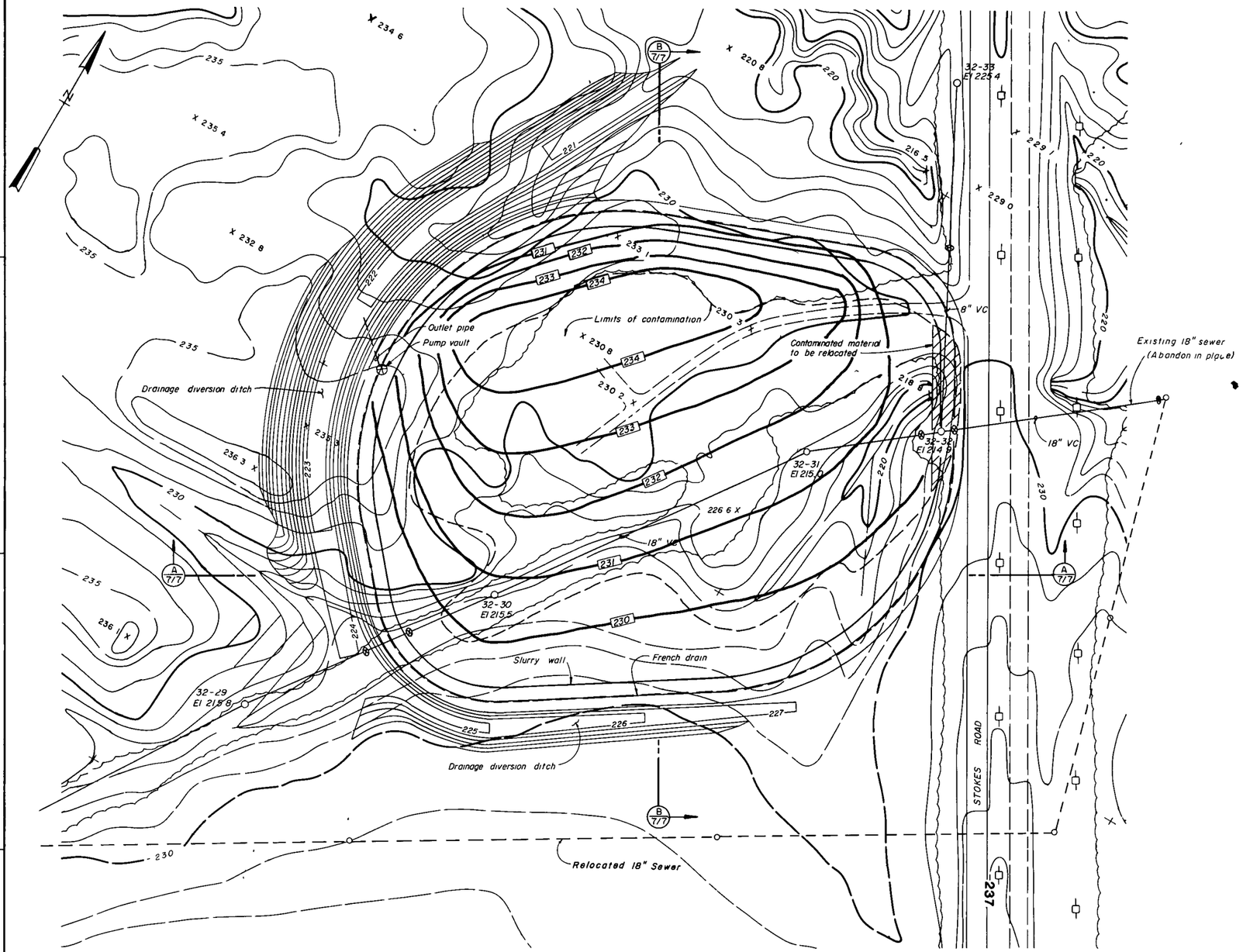
Date

Dwg Code

Sheet reference number

Sheet 4 of 7


E1,981,000
E1,923,500
E1,981,500
E1,924,000
E1,982,000
E1,924,500
N593,500
N12,451,500
N593,000
N12,451,000
N592,500
X 236 1
X 232 3
X 233 8
X 226 2
X 232 5
X 219 0
X 229 1
220 3 X
X 224 8
X 220 8
216 5 X
X 229 0
X 234 6
236 2
X 233 1
230 3 X
218 8 X
Manhole
X 235 4
X 230 8
230 2 X
226 6 X
X 232 8
X 235 3
236 3 X
X 236 2
Excavation for sewer trench penetrates Jackson along this alinement
LEGEND
218 Top of Jackson contour
SCALE IN FEET
50 0 50 100
Revisions
Symbol | Descriptions | Date | Approved
US ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA OKLAHOMA
Designed by
Drawn by
Checked by
Submitted by
Chief Geotechnical Branch
PINE BLUFF ARSENAL
PINE BLUFF, ARKANSAS
PN 83 FY 86
HAZARDOUS LANDFILL/CLOSURE SITES
SITE 24
TOP OF JACKSON CONTOUR
Scale As Shown
Date
Dwg Code
Sheet reference number
Sheet 5 of 7



LEGEND

- French drain
- Slurry wall
- Plug sewer
- 230 Final contours

PLAN - SITE 24

SCALE OF FEET

50' 0 50 100'

Revisions			
Symbol	Descriptions	Date	Approved

U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA OKLAHOMA

Designed by

Drawn by Harold W. Abbott

Checked by

Submitted by

Chief CIV ENG SEC

PINE BLUFF ARSENAL
PINE BLUFF ARKANSAS
PN 83 FY 86
HAZARDOUS LANDFILL/CLOSURE SITES

SITE 24
CLOSURE PLAN

Scale AS SHOWN

Date JULY 1985

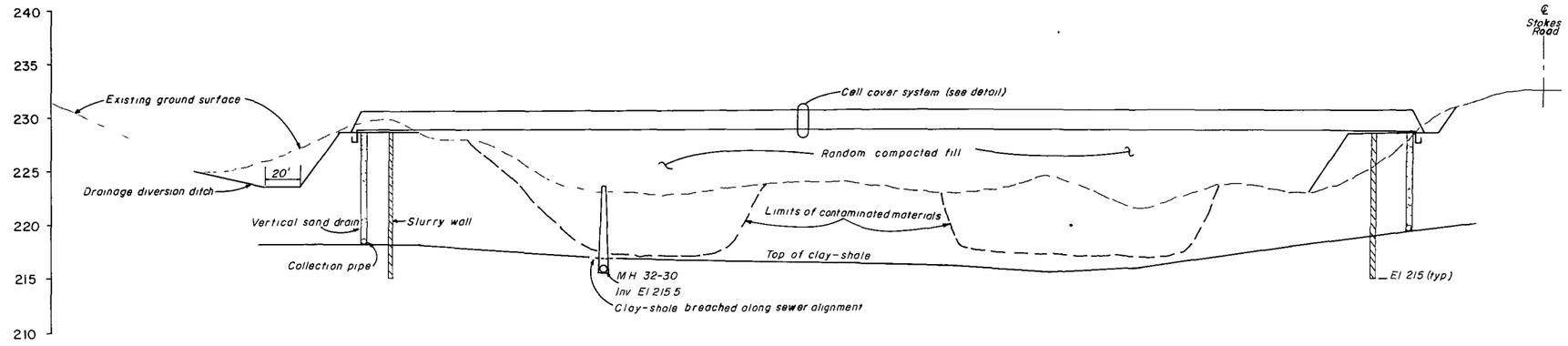
Dwg Code F-890-90-01

Sheet reference number

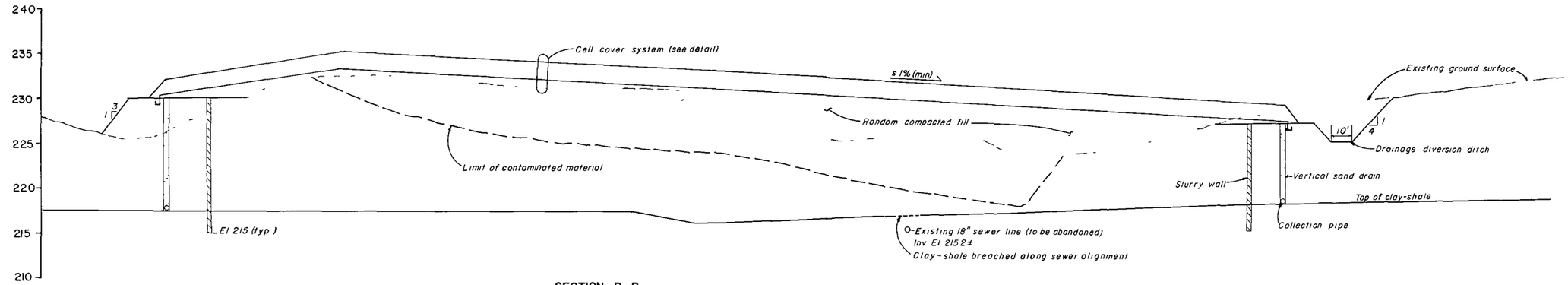
Invitation No DACA 56- B

Contract No DACA 56- -C

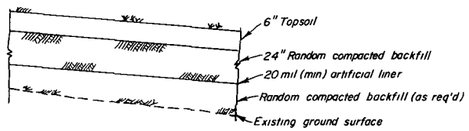
Sheet 6 of 7



SECTION A-A
SCALE 1"=30' HOR
1"=5' VER



SECTION B-B
SCALE 1"=20' HOR
1"=5' VER



COVER SYSTEM
NO SCALE

Revisions			
Symbol	Descriptions	Date	Approved

U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA OKLAHOMA

Designed by

Drawn by Robert Roby

Checked by

Submitted by

Chief CIVIL ENG SEC

PINE BLUFF ARSENAL
PINE BLUFF, ARKANSAS
PN 83 FY 86
HAZARDOUS LANDFILL / CLOSURE SITES

SITE 24
SECTIONS & COVER DETAIL

Scale AS SHOWN
Date AUGUST 1985
Dwg Code F-890-90-01
Sheet reference number
Invitation No DACA 56- B-
Contract No DACA 56- C
Sheet 7 of 7